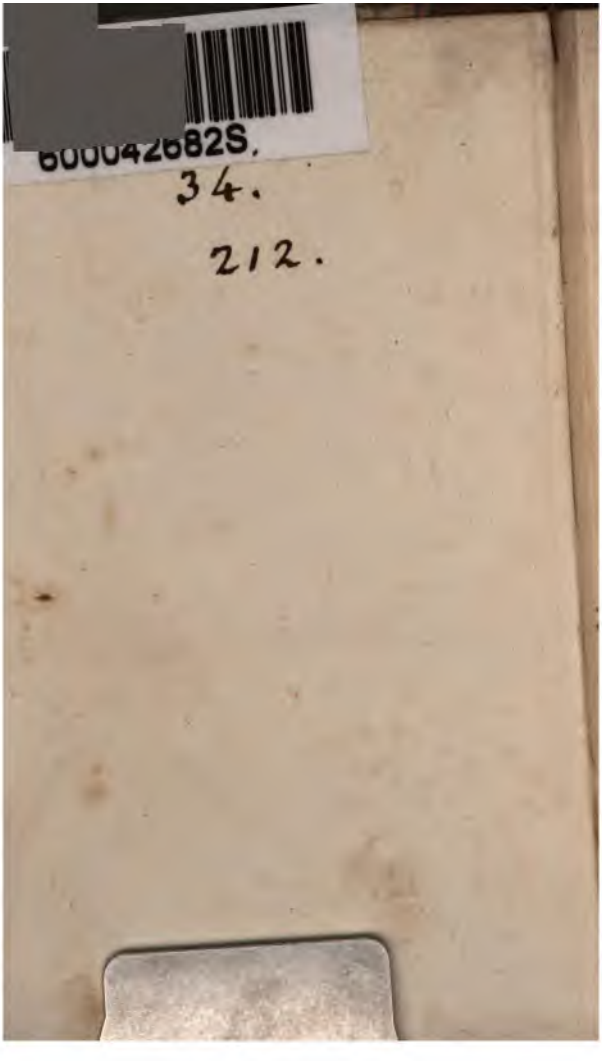

THE

SEA-SERVICE:

OR,

POPULAR SKETCHES

OF

SHIP-BUILDING, NAVIGATION, AND NAVAL WARFARE;

FROM THE EARLIEST PERIOD TO THE PRESENT TIME.

BY THE AUTHOR OF "A YEAR IN SPAIN."

Illi robur et æs triplex
Circa pectus erat, qui fragilem truci
Commisit pelago ratem
Primus.

HORACE.

LONDON:
JOHN LIMBIRD, 143, STRAND.

1834.

PREFACE.

THE substance of the following pages was originally written at the request of Dr. Leiber, the learned editor of the "Encyclopædia Americana," of which valuable work it forms three articles. They are now reprinted, with such additions, as to complete a concise, historical, and practical outline of the navy, from the origin of ship-building to the present improved state of naval science.

The writer, a lieutenant in the United States' navy, who has served nearly nineteen years, and more than half of it in cruising ships at sea, must be allowed to have entered on his task with the qualification of experience. "Whilst an ardent love of his profession rendered the subject peculiarly agreeable, he felt also that it ought to be of great and universal interest. What person, indeed, of the least reflection, can look upon that perfect and most beautiful of all artificial objects, the sailing ship, with the quiet and ordinary interest that other works of art inspire? Who can behold her gliding proudly and gracefully over the bosom of the deep, braving its perils, and disregarding the opposition even of the element by which she is propelled, and at length arriving safely, freighted with all her treasures of comforts, luxuries, and intellectual stores, without pausing to admire, and to bless this great link in the chain of our civilized existence?"

"The object of this republication is to disinter the articles *in question from* the work of reference in which *they have been,* as it were, buried, and to place them in

a convenient form before those who may be anxious for information on a subject which appears to the writer, as he has already said, to be one of universal interest. As a junior officer of the navy, the author would not for a moment indulge the belief that any new ideas could be gleaned from his unpretending pages, by those who are his equals or superiors in the profession. Yet such may perhaps be repaid in the perusal, by the pleasure which is often found in the reoccurrence of the most familiar ideas. The younger midshipmen, however, to whom he presumes specially to offer this little work, may, in the outset of their career, gather from it a general idea of the noble profession upon which they are entering."

To this portion of the author's preface, it may be added, that the practical details of the following pages, so far from being encumbered with technicalities, will be intelligible to every reader; since the work for which they were originally prepared, has the credit, above all other works of its class, of affording concise and popular information on subjects on which the inquirer is presumed to be uninformed. These advantages will be found especially evident in the chapters on Ship-building and Navigation, the practice of which is explained in an unadorned and simple manner, so as to make the reader familiar with the leading details of the subject. The outlines of Naval Warfare are written with equal simplicity; and such of its stirring scenes as stand most prominently from the canvass of history, are sketched with graphic vigour, so as to render this little volume by no means unworthy of the vivid pen of the Author of "A Year in Spain."

London, Feb. 1834.

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NAVAL WARFARE.

SHIPS.

INTRODUCTION—ORIGIN OF SHIPS—FIRST FORMS THEY ASSUMED—FABLES OF THEIR INVENTION—CONSTRUCTION AMONG PHŒNICIANS, GREEKS, AND CARTHAGINIANS—THEIR OCCASIONALLY ENORMOUS SIZE—DECLINE OF THE ART UNDER THE GOTHS—REVIVAL DURING THE CRUSADES—EFFECT OF THE DISCOVERY OF THE COMPASS—GRADUAL ADVANCES TOWARDS MODERN PERFECTION—DESCRIPTION OF THE GREAT HARRY—MODERN CONSTRUCTION—THE AMERICAN SCHOONER PERFECT—PRINCIPLES OF MODELLING—FRAMING—FASTENING AND PLANKING—THE LAUNCH—SPARS AND RIGGING—THE SAILS—BALLAST AND CARGO—WEIGHING ANCHOR—EVOLUTIONS AT SEA—REDUCING SAIL IN A GALE.

As no human device is more worthy of admiration than the ship, so no investigation can be more curious than to trace, step by step, the slow progress of improvement, from the first rude attempt of incipient navigation, down to the perfection of modern times. And here, at the very threshold of the inquiry, our attention is arrested by a singular fact—the uniformity with which the human mind, prompted by the same desires, and aided by the same *faculties*, arrives at uniform results. How *small, indeed,* is the difference between the canoe

of the Esquimaux, framed of the bones of beasts and fishes, and covered with the skins of seals, and those in which the poets show us Dardanus fleeing before the deluge, or Charon conducting his trembling charge to the shades below; between those said to have been used in primitive times by the Egyptian, the Ethiopian, and the Arab, and the light barks of the early Britons, made of osiers and hides, which Cæsar imitated in Spain to extricate himself from the perilous situation in which he was held by the lieutenants of Pompey! In what does the canoe of our own Indian, of the islander of the south seas, and of the native African, differ from those which the savage Germans hollowed from a single tree, in the days of Pliny?

It is an old tradition, that the first idea of the canoe was suggested by a split reed, seen by some ingenious savage floating safely upon the billow. Be this as it may, there can be little doubt that the raft, as it is the most easy and obvious means of crossing the water, was likewise of most early invention. The savage who first ventured forth upon a solitary tree, that the river had brought within his reach, must have found his situation unsteady and precarious: his ingenuity suggested the idea of fastening several together, and the conveyance became *at once* a safe one. The earliest records

which history affords on this subject, show the Egyptians traversing the Nile upon rafts. The Phœnicians also availed themselves of the invention; and we are told that many islands, even the remote ones of Sicily and Corsica, were colonized with no better assistance. This will seem less improbable, if we remember that the Peruvians still make sea-voyages on their raft, called *balza*, from the spongy tree of which it is made. It consists of a number of logs tightly bound together, and strengthened transversely by beams. They are tapered at the prow, to facilitate the division of the water, whilst vertical planks, descending below the surface, prevent drift, and enable it to sail towards the wind. These *balzas* we have met in the open ocean, loaded with from ten to twenty tons of merchandise, and contending effectually with the trade-wind which prevails along the coast of Peru. This form of ship is not, however, always safe; lifted as the logs are unequally upon the waves, the thongs which bind them together, if old or neglected, sometimes break or disengage; the bark of the mariner disappears treacherously beneath him, or the logs, crashing rudely together, serve for his destruction. Yet the attempts of the uncivilized navigator do not always shun comparison with those of a maturer age. *We find the* native of North-western America, *in his little* skin-covered bark of admirable sym-

metry, venturing forth amid the most boisterous waves, which pass harmless over him, and outstripping the fleetest barge in his rapid course. The flying proa of the Ladrone islands sail towards the wind with unequalled nearness, and with a velocity far greater than civilized man has ever attained, with all the aids of philosophy.

It were a vain task to record the various fables connected with the origin and improvement of ships, though the inventors were esteemed worthy to take rank among the gods, and even the ships to be translated to the heavens, where they still shine among the constellations; how Dædalus invented the art of flying, to escape from the labyrinth of Crete—an allusion to the sails with which he eluded the pursuit of Minos; how Hercules sailed with the hide of a lion, which was only his well-known garment hung up for the purpose; or how the first idea of the sail was taken from the poetic voyages of the nautilus; how Atlas contends for the invention of the oar, and how many heroes claim the honour of the rudder. These inventions all, doubtless, originated in the earliest dawnings of civilization, before there were any means of recording them; and the ascription of them to individuals may have formed the pastime of succeeding poets. It may *not, however*, be equally vain to inquire what was

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the progress of improvement. They had a horror of Typhon, as they termed the sea, because it swallowed that sacred river, which, being the great source of their happiness, they worshipped as a divinity. This horror extended to those who led a sea-faring life; hence the Phœnicians were not allowed even to enter the Nile. Driven to extend their voyages seaward, these mariners adapted their ships to the necessities of a more precarious navigation.

Coeval with the Phœnicians in the use of ships were the inhabitants of China. But, situated as they are, in the neighbourhood of a circumscribed sea, surrounded by islands, and, moreover, possessing, in their own resources, a supply for every want, discovery and improvement have long lain dormant there. It is believed,—and the fact is wonderful,—that the Chinese have floated down through thirty centuries in the same shapeless junk which now excites the ridicule of our seamen, and which they are yet unwilling to exchange for the improved models which daily pass them in their own seas, and continually force upon them the most humiliating comparisons. In the Chinese junk of our day we may, perhaps, see the counterpart of what the ship was in the days of the Phœnicians and of incipient navigation. Among the Phœni-

cians, Carthaginians, and Greeks, the earlier ships used in commerce were flat-floored, broad, and of small draught of water; the floor-timbers were continuous at first, and they were without a keel, having instead a streak of wood on either side, to take the ground when stranding. Next, the keel was introduced, in order to diminish the drift with a side wind; and, to increase the strength, a keelson was soon added, overlaying the floor-timbers, and confining them to the keel; beams were also placed aloft, to hold the sides together and sustain the deck. The planking, which took its name, among the Greeks, from the garment which covers the human body, was firmly attached to the frame by means of iron nails, some of which passed through and were clenched within. When, however, the ancients discovered the tendency of iron to rot the wood, they substituted copper. To obviate the danger of starting the plank ends,—a danger still sometimes fatal to the mariner,—a piece of wood was let into both in the form of a dove-tail. Oak and pine then, as now, were the woods most in favour; chestnut and cedar were also used, and to the last the Greeks gave the name of everlasting wood, though it was found not to hold well when nailed in the ordinary way, and to grow iron-sick; *cypress, not being* subject to shrink and cause *leakage, was also* esteemed, and elm wood was

placed in such parts as were constantly under water. The Romans were very particular as to the season of felling ship timber; aware that there was much to be gained by attention to this subject, though mistaken as to the means. They would only fell between the fifteenth and twenty-third days of the moon's age, believing that when it was on the wane, the sap, which is the chief cause of early decay, descended; they were also attentive to the quarter from which the wind blew; in autumn it should be westerly, in winter, north. To stop the leaking at the joints, lime and pounded shells were first applied; these being found soon to fall off, wax, rosin, and pitch were advantageously substituted; flax was also driven into the seams, and leather occasionally used as a sheathing. A vessel of the time of Trajan, raised, after thirteen centuries, from the bottom of a lake, was found to have a bottom of pine and cypress, still in a sound state; her seams were calked with linen smeared with pitch, then sheathed with sheet-lead and copper-nails. Nor were the ancient vessels without ornament; the prow was especially decorated with paint and gilding, representing the forms of the gods; taking its name from the human face, its sides were called the *cheeks*. Its foremost extremity was usually *carved* into the representation of men and animals, or *also formed* a graceful curve; where it divided

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into the galley, which being moved chiefly by oars, was of an entirely different form from the merchant-ship. Extreme narrowness, in connexion with great length, for the accommodation of many rowers, determined the form of the first, while the latter was constructed mainly with a view to capacity; hence the length of the galley was often six or eight times its breadth, whilst that of the merchantman was but four times; and hence, too, their distinctive names of long ships and round ships. The size of the earlier ships was necessarily inconsiderable, as they were drawn on shore at the termination of every voyage, and had but a single mast and sail of cloth, or at first of leather, managed with ropes of the same, or of bark, broom, or hemp. When, however, the keel was added, and the size increased, stranding became no longer practicable, and the anchor and cable were invented to confine the ship at a due distance from the land. At first, this useful machine was but a large stone; it was afterwards of wood and stone combined, and lastly, of iron, having teeth; the largest anchor, called the sacred, was only cast in extremity. In the progress of enlarging their ships, there is no doubt that the ancients attained, at length, a size quite equal to the most monstrous of modern times. Even deducting much from the recorded size of *the cedar ship* of Sesostris, and the Isis of Ptolemy

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Thus we have a Roman ship laden with twen
hundred tons; the Santissima Trinidad could
carried no more. These enormous produc
like the obelisks themselves, owed their exis
not less to the hardy genius than the despoti
stitutions of the times; that they were unma
able masses, and were regarded in those tim
monsters, may be gathered, not merely from
names of Cyclades or Ætna, but from the s
fact that a ship of only fifty-six tons is insta
by Cicero, for her magnitude.

Such was naval architecture in the ages pri
the Gothic invasion, which drove this art,
every other, back into barbarity. We are told
the ships in which the Saxon pirates cruised i
German ocean, and invaded Britain, were
with a wooden keel, sides, and upper worl
wicker, and an exterior of hides. Though
may have improved somewhat on this pri
construction, yet it is certain that much of the
vious advances in ship-building, the accumul
of many centuries, was forgotten, and to be
covered and tested anew. The brisk trade c
on in the Mediterranean, and the naval enter
connected with the crusades, occasioned som
provements; yet the art advanced little, if a
beyond the condition in which the Carthag

left it. It was not until the middle of the fourteenth century that the inconsiderable war-galleys of former times began to be superseded by larger vessels, in which oars were not entirely exploded, but which were chiefly moved by sails. These were crude enough; of crooked, half-moon shape, very high at the stem and stern; the planks nailed with iron, not set edge to edge and calked, but overlapping, like those now seen in clinker-built boats. They had usually but one mast, never more than two, with square sails attached to yards, and were only capable of advancing with a favourable wind. What a contrast between these rude machines and the noble production now called a ship, in which art and science are exhausted, the result of the gradually accumulating improvements of many generations! Sir Walter Raleigh well says, "Whoever was the first inventor of ships, every age has added somewhat to them; and in my time they have been greatly bettered. It is not long since striking the top masts has been devised, together with the chain-pump, which taketh up twice as much water as the old one: we have now studding sails, and the weighing of anchors with the capstan; moreover, we have fallen into consideration of the length of cables, and by it we resist the malice of the *greatest winds*; for true it is that the length of *cable is the life of* the ship."

Ship-building made, indeed, but a snail-paced progress until the introduction of the compass; and the application of astronomy to nautical pursuits at once set the mariner free from dependence on the land. The discovery of America resulted from these improvements and the inspiration of a single man. Thenceforward the mariner, thrown upon the wide ocean, was brought into contact with unknown perils, and to obviate them was led to untried expedients. The art has since strode forward with giant steps. To the Italians, Catalans, and Portuguese, belong most of the advances in the earlier days of its revival; the Spaniards followed up the discovery of the new world with a rapid improvement in the form and size of their ships, some of which, taken by the cruisers of Elizabeth, carried twenty hundred tons. In modern times, to the Spaniards and French belongs the entire credit of the progress which has been made in the theory of the art. Strange as it may seem, few improvements have originated with the greatest naval power of this or any other time. We have the authority of her own authors for the singular fact, that Britain has added little to the beauty, speed, and excellence of ships, the wooden walls to which she is indebted for her security. In our own country, ship-building has made unprecedented progress; with, however, *little aid from* theoretical principles and abstract

science. And hence it may well be questioned, whether a blind attachment to arithmetical results —modified, as they must be in practice, by many causes escaping calculation—does not often serve to sanction error. The example of our builders sufficiently proves that the artist, guided by experience and a practised eye, may dispense with elaborate theories; which, after all, are but the demonstration and systematic utterance of ideas which already exist in the untutored mind, and are daily acted upon. Experiment, though it may gain something from theory, is the only infallible guide. The Greeks construct beautiful, graceful, and fast vessels, without either draughts or moulds ;—their only guide being a practised eye.

In order to appreciate the extent and value of modern improvements, we have only to refer to the figure of the old ships, preserved in pictures of the most famous, and which may be found engraved in Charnock's valuable work on naval architecture. There we see the Great Harry, the wonder of the sixteenth century, a most terrific-looking monster. Her bow and poop are of prodigious height, the signal lantern on the latter being nearly level with the round tops. She has an immense beak, with bow *and stern balconies*; six round towers at the *angles of the poop*, gangway, and forecastle, like

the turrets of a château ; four masts, with tops literally round, like inverted cones, and abundance of streamers from every spar. Even at the beginning of the seventeenth century, a vessel constructed by the Duke of Northumberland, a schemer of that day, and then esteemed a miracle of perfection, measured fifty-four feet more on deck than at the keel, and was thirty-three feet high at the bow, fifty-one at the stern, and only twenty-eight in the middle. It is true that, very shortly after, a ship, launched in England, and called the Royal Prince, was very little different from those of our day, except that she was everywhere encrusted with carved work and gilding. Yet this is a solitary and uncopied example, for builders clung pertinaciously to their inequalities, excrescences, and inflections, down to a late period of the last century. Indeed, in most nations of Europe, a high poop and inflected topside are still partially continued, though no longer to the extravagant degree which characterized the fashion at its height when it was not unusual to see a ship taper upwards to half her extreme breadth. In the United States alone is this custom entirely abolished, experience having shown us, what theory may also demonstrate, that it is vicious in every respect; that, while nothing can be urged in favour of tumbling in,—as it is well called,—but *that it brings* the guns nearer the centre, and hin-

ders the smoke of the lower from incommoding the upper decks, it adds greatly to the difficulty of draughting, and the expense of timber and construction, at the same time taking from the spaciousness of the upper deck, increasing the crankness of the hull and the insecurity of the masts by allowing no spread to the shrouds which support them. The long-established custom, too, of making the deck rise into a little mountain abaft, with the sole view of accommodating the commander and other great men with better quarters, has been as little respected in our republican country. We have reduced the whole topside to one uniform, unbroken level. Hence there are no obstructions to catch the wind: and, moreover, our vessels, being lighter at the extremities, pitch and perform their vertical motions with more ease. Hence, too, they are less exposed to camber, or become broken-backed,—a bending downwards of the extremities, which takes place in all vessels, more or less, at the moment of launching, and which is promoted when at anchor by the downward pressure of the cables, and at all times by the unsustained gravitation of the extremities, from their extreme sharpness, counteracted at the centre by the accumulating pressure of the resisting fluid in an upward *direction. Thus, if* we compare our ships with *those of the last* century, it will be seen that our

improvements have consisted rather in taking away than in adding; and hence the latter, being of infinitely more intricate and involved construction, would also seem more difficult to devise. But experience shows that the simplest forms are not the most obvious to discovery; the Grecian style of art, the embodied idea of simplicity, was the fruit of an age of the highest refinement. What the Parthenon, or Maison Carrée, is in civil, the American schooner—a model peculiar to ourselves—is in naval architecture. She is of the simplest form, carrying the greatest breadth before the centre; the bow is very sharp, and the draught forward inconsiderable, but increasing towards the stern, where it becomes almost double. With great length and breadth, furnishing stability to bear a large surface of sail, and great depth to take hold of the water and prevent drifting, the burthen and consequent displacement of the schooner are inconsiderable, a large part of the bottom consisting of mere dead wood. Above water, her form is straight, low, and unbroken, offering no obstacle to the wind; the masts are long and tapered, and the sails, like the body, adapted to approach the wind, which the schooner does within forty or forty-five degrees, just twenty degrees nearer than the best *equipped* frigate, and she will sail in moderate *weather as fa* nd as from it. Unless,

indeed, in gales, when her excessive speed, in conjunction with her wedgelike form, tends constantly, as she runs over the water, to raise the bow, and by counterpoise, to depress the stern, to the danger of being overtaken by a pooping sea; the schooner going large is also victorious. It may be possible, in smooth water, with a vessel like the flying proa, or with a double boat of capacity to bear a single man, to surpass the speed of the schooner; but not with any vessel capable of traversing the sea, whether moved by natural or artificial agents. If it be considered that, in doubling the velocity of a body moving through a fluid, that body not only impinges on twice as many particles of the fluid, but on each of them with twice its former force, so that the resistance increases as the squares of the velocity, it may well be wondered how a speed of twelve, thirteen, and even fourteen sea-miles the hour, has at length been attained.

Let us now proceed to the leading object of this portion of our subject—to give an idea how, in our day, a ship is built, masted, rigged, and, finally manœuvred; premising, simply, that it is not so much our desire to suggest new notions to those who are familiar with the subject, as, in accordance with the *plan of this work*, to convey a plain yet palpable *idea to those to* whom it is yet a mystery. The

nicest and most difficult operation in ship-building consists in forming the draught. This is done, in Europe, by representing the form of the proposed ship in three distinct points of view. The first is called the sheer plan, and gives a complete view of the side; here are represented the length, depth, rake of the stem and stern; the wales, waterlines, decks, ports, masts and channels. The body plan shows the breadth, having described upon it every timber composing the frame of the ship; those running from the place of greatest breadth forward being described on the right hand; those running aft, on the left. Lastly, there is the half breadth or horizontal plan, showing the whole as if seen from above. To construct these draughts is exceedingly intricate and laborious; and, when finished, they convey no very clear idea of the intended ship. Our American builders have a different mode, very easy and satisfactory. They begin by making a wooden model of the proposed construction, the thing itself in miniature. Here the length, breadth, bulk, all the dimensions, and most minute inflections of the whole, are seen at a single glance; the eye of the architect considers and reconsiders the adaptation of his model to the proposed object, dwells minutely on every part, and is thus able to correct the faults of his future *ship, at the* mere expense of a few chips, and while yet *in embryo.* We shall now state what are the es-

sential qualities of a good ship, and how they are attained. In a ship of war, the great object is speed, connected, as far as may be, with ease of movements, and capacity to accommodate her crew and carry a large supply of water and provisions. One point, moreover, is especially to be looked to; this is, that the ship float sufficiently high above water to run no risk of receiving seas in her lower ports in time of action. In order to be secure of this, the constructor must make an estimate of the whole weight of the ship, including body, spars, armament, men and munitions, and must so model the bottom that it will have displaced an equal weight of water when arrived at the desired depth. But in the merchantman, of which we now particularly speak, the primary consideration is, to attain the greatest capacity to carry cargo, combined, as far as possible, with safe and easy movements and rapid sailing. Now, the only way to combine these qualities with any success, is to imitate a form which has stood successfully the test of experience. This the builder does when he forms his model, guided by a tasteful and accurate eye, accustomed to notice the forms of vessels, and to mark particularly those which have been distinguished for their good qualities. In this way the American builders have succeeded in uniting these conflicting desiderata in a degree heretofore deemed impossible. Our packet-

ships carry enormously, while, at the same time, their extreme speed has reduced, by one half, the time of passage to Europe.

Among the admitted and well-established principles of construction, is the leading one, that the greatest breadth must always be before the centre, and consequently the bow be more blunt than the stern. Some of our best builders place this point only one third of the length from the stem. Abstractly, it would seem most important that the bow should be adapted to divide the water with the least possible resistance; but experience has proved that it is far more essential to facilitate the escape of the displaced water along the side of the vessel; for when once a passage is opened for the ship, the fluid tends to reunite abaft the point of greatest breadth, where, instead of offering resistance, it presses the ship forward, in its endeavour to recover its level and fill the vacuum constantly opening behind her. Without recurring to Sir Isaac Newton for the demonstration by which he has shown the mathematical truth of this principle, it may be sufficient to instance the fact, familiar to every seaman, that a log tows infinitely easier by its bigger end; nor do we find a trifling concurrent testimony in the *forms of the* finny tribe, which an unerring nature *has adapted to* divide the element they move in, by

a shape gradually diminishing from head to tail. As it is, then, less essential that a ship should be sharp forward than aft, there is a further advantage in having the bow full towards the edge, that it may check her in descending into the waves, not abruptly, but gently; pitching being the most dangerous to hull and spars of all a vessel's movements. Though sharpness towards the sternpost is vitally essential to fast sailing, yet care must be taken to leave the buttock full towards the surface, in order to check the stern gently in descending, and, when scudding before a gale, to lift it in timely season, on the arrival of a sea. To hit the exact mean in this respect, so as not to retard the sailing, on the one hand, nor on the other to endanger the safety of the ship, requires all the skill of the architect. The midship floor should be nearly flat, in order to render the ship buoyant and stable, or capable of bearing sail. It has been suggested, that since stability is in proportion to the length, an elongation of ships might be productive of increased speed; but though they would thus be enabled to carry more sail without an essential increase of resistance, yet it may well be questioned whether this advantage would not be more than compensated by the corresponding increase of difficulty in turning, *manœuvring*, and rising to escape the breakings of the sea. There must also be a loss of

compactness and strength proportionate to the increase of length, so that such vessels may be only adapted to the smoothness of a lake, or to the purposes of privateers and smugglers, who are desirous to procure rapid movements at whatever sacrifice. An increase of breadth may produce equal advantage without any sacrifice: for, inasmuch as stability increases as the cubes of the breadth, by adding one quarter to the breadth, you gain a double stability, and by consequence, a capacity to bear twice as much sail, with but one fourth of increase in the resistance. If it be remembered that the pressure of the water increases in descending from the surface, and that from this cause and the augmented difficulty of displacing it, the resistance offered to a ship in advancing is three times as great at the lower as at the upper half of the immersed section, there can be no doubt that if the law for measuring tonnage left his dimensions optional to the builder, the excess of depth now used would be transferred to the breadth. This being the case, it is deplorable that our government should so long have retained the old rule for the measurement of tonnage. This takes only into consideration the length and breadth at a single point, and consequently furnishes no standard *whatever to judge* of the capacity; hence, the merchant may have his ship made as deep as he pleases,

and carry her breadth down to the floor itself, without any increase of tonnage; and one of three hundred tons may thus be made to carry three times as much as another of equal measurement, formed for speed and beauty. Now, as a ship's port-charges are determined by her registered tonnage, this is a direct bounty for building ugly and disproportioned ships, and an equally direct tax upon every digression from the model of a bread-tray. Great detriment to the appearance, speed, and safety of our freighting ships results from this absurdity. But to return to our subject; an extreme in breadth, as in length or depth, is also dangerous. All extremes are here to be equally avoided. In civil architecture, an extravagance may be an eye-sore to men of taste, and render the projector ridiculous: but in naval, it too often proves fatal to human life.

Keeping, then, all these principles in view, as far as the tonnage law and the interests of the merchant permit, the builder proceeds to form the half model of his proposed ship, making it of the usual relative dimensions (a quarter of an inch to the foot.) When satisfied with his performance, he takes asunder the horizontal sections of plank of which the block was originally formed, and he has *before him all the* waterlines in miniature. Having

marked these on the floor of the moulding loft, he has all the necessary data, and proceeds to draught the entire frame. This done, pine-moulds are formed of all the different parts, and the preparatory labours are complete. The scene now changes from the moulding loft to the ship yard, and the builder turns his attention to the materials. The timber most in request is oak, pine, chestnut, locust, cedar, elm, beech, &c. In the United States, where we have abundant supplies, our constructors confine themselves almost entirely to live and white oak, pine, chestnut, locust, and cedar. The felling and choice of timber is in itself an art. The tree should be taken in the second era of its growth, when it has attained maturity, without approaching the period of decay. It should be killed by removing a ring of bark, at the beginning of winter, when the sap is down, and left to dry and harden before it be cut down. When felled, the timber should be carefully stored in some dry, airy place, not much exposed to wind and sun. Painting should not be used, as, by sealing up the moisture in the wood, it rather facilitates than prevents decay; smearing with oil or tar when well dried, is not so open to objection. In collecting ship-timber, the greatest difficulty is found in procuring the *crooked sticks*, of which so many are required. *In countries* where timber has become an object

of careful cultivation, this difficulty is anticipated by bending and confining the young trees to the desired form, or by cutting their young shoots at different periods, it having been observed that pollard-trees are thus naturally produced by the browsing of cattle. The timber being collected, the workmen, with each his mould, proceed to fashion the pieces of wood assigned them, a due regard being had to careful conversion, that no stick is hewn contrary to its grain, so as to impair its strength, nor a larger one ever used than is necessary for the particular purpose; and especially, that no bad or even indifferent wood be put in an important place, whence it could be removed only with difficulty.

The frame being now ready, we proceed to put it together. And, first, the blocks are placed in the slip, and the keel laid upon them, the pieces being snugly scarfed together and bolted; the keel is also scarfed to the stem forward, and the sternpost aft, the apron being raised with the stem, and the transoms and fashion pieces with the stern, if the vessel be not large. In laying down the keel, great care must be taken to preserve its perpendicularity, for which purpose it is pinned with tree-nails on *either* side of the blocks; also in raising *and propping* the stem and stern, and every piece

of the frame. It is only by extreme attention that the builder avoids producing a crooked ship—an artificial monster of by no means rare occurrence. The floor-timbers are now let into the keel, and every other one is there firmly bolted and riveted; they are crotches of trees formed by the trunk and one of the branches. Hence, in order to have equal strength on both sides, the butts should be placed alternately to right and left. As the floor-timbers are the great connecting principles of the ship, to which they bear the same relation as the ribs to the body, too much care cannot be taken in selecting and securing them. The dead wood which fills up the angles at the stem and stern being got in, the kelson is laid upon the floor-timbers, which let into it, until it rests upon the keel; its pieces are scarfed together, and to the stemson and sternson, which form its prolongation up the stem and stern. A bend usually consists, besides the floor-timbers, of four futtocks and one top timber, on each side; the first, or lower futtock, descends to the b[illegible]side the floor-timbers, to which it is cl[illegible]or [illegible]with treenails; the heel of t[illegible]ead of the floor, and bolt[illegible]nd so on up to the [illegible]and stern, the tim-[illegible]t angles, but are [illegible]aft, as well to

economize timber, by adapting the sticks to the inclination of the curves, as to augment the strength of parts much exposed to shocks from waves, rocks, and icebergs. The different portions of the frame are thus raised to their places by sheers and tackles, and then carefully shored and kept to the proper breadth by cross pales; ribands are also carried round the frame and bolted, and every precaution taken to confine each separate part to its particular position. The frame being now complete, is dubbed smoothly off within and out, preparatory to planking. Sometimes the frame is made completely solid, and calked; in this case, the interior covering of plank is dispensed with, excepting a few strengthening streaks. This method has many advantages; a little additional width to the timbers brings them in contact, when, besides their being naked and exposed to the air within, there is no space for the generation of those destructive gases which cause dry rot. In this case, salting, which makes a ship damp and unwholesome, is also avoided.

Having advanced thus far in the construction, the next care is to proceed with the planking, which does not merely serve to exclude the water, but to *protect, connect,* and bind harmoniously together, *and is quite* as essential as the skin to the body

of the frame. It is only by extreme attention that the builder avoids producing a crooked ship—an artificial monster of by no means rare occurrence. The floor-timbers are now let into the keel, and every other one is there firmly bolted and riveted; they are crotches of trees formed by the trunk and one of the branches. Hence, in order to have equal strength on both sides, the butts should be placed alternately to right and left. As the floor-timbers are the great connecting principles of the ship, to which they bear the same relation as the ribs to the body, too much care cannot be taken in selecting and securing them. The dead wood which fills up the angles at the stem and stern being got in, the kelson is laid upon the floor-timbers, which let into it, until it rests upon the keel; its pieces are scarfed together, and to the stemson and sternson, which form its prolongation up the stem and stern. A bend usually consists, besides the floor-timbers, of four futtocks and one top timber, on each side; the first, or lower futtock, descends to the keel, beside the floor-timbers, to which it is either bolted or pinned with treenails; the heel of the second rests upon the head of the floor, and bolts to the side of the first; and so on up to the top timber. Towards the stem and stern, the timbers do not meet the keel at right angles, but are *inclined* respectively forward and aft, as well to

pending the anchors, hatchways, mast holes, and a variety of other objects, which, though too many to enumerate, must by no means be forgotten—all being complete, the carpenter makes room for the calker, who carefully stops all the seams with oakum, and smears them with pitch. The scraper follows the calker, and, water having been pumped into the hold, to ascertain whether there is any leak, the bottom is ready to be sheathed or coppered, to protect it from the worms. Sheathing with wood is practised with iron-fastened ships, because copper would cause the bolt-heads to corrode, if placed against them. It consists simply in covering the bottom with pine-boards, sheets of paper soaked in hot pitch being placed between. In sheathing with copper, paper or felt is also interposed. The plates overlap each other from bow to stern, to prevent their being stripped off by the continual shock of the passing water.

Our ship is now ready to be launched. This is the triumph of the builder. It is a nice operation, and is thus performed:—If there be no ways in the slip (which is always an inclined plane descending into the water,) they are immediately prepared. Two parallel platforms of solid timber are laid, *one on each side* of the keel, at the distance of a *few feet from it*, and extending from the stem as

far below the stern as can be reached at low water. In this position they are carefully and firmly blocked and supported throughout their length. This double platform is called the ways. Upon it a second system of timber is loosely laid, and well greased between. The space from these last to the ship's bottom is every where filled with wedges of soft wood fashioned to its curves. The whole is called the cradle. The extremities of the cradle at the bow and stern are bound tightly across the keel with chains or ropes, and it is further kept from spreading by stout mouldings, which overlap the outer edges of the ways. When the rising tide has reached well up the ways, the wedges are simultaneously driven on every side, and the ship is raised from the blocks on which she has hitherto rested, and made to repose entirely on the cradle. The shores are all removed except the two spars planted against the counters, and when the proper moment has arrived, these are also knocked away. The vessel, now abandoned to her weight, and encouraged by the yielding of the grease, begins slowly falling on the inclined plane; her motion becomes at each moment more and more rapid; the ways smoke and ignite with the pressure and velocity of the moving mass; and, in a twinkling, the noble fabric has abandoned for ever its unworthy union with the land, and entered gracefully

and joyous, upon its destined element. Among the ancients, a launch was ever an occasion of great festivity. The mariners were crowned with wreaths, and the ship bedecked with streamers and garlands. Safely afloat, she was purified with a lighted torch, an egg, and brimstone, and solemnly consecrated to the god whose image she bore. In our less poetic times, there is no lack of feasting and merriment, though, instead of the torch, the egg, and the brimstone, the oldest sailor breaks a bottle of rum (unless, indeed, he may have slily substituted water as more appropriate to a christening) over the head of the emblem—still, perchance, the image of father Neptune or Apollo.

The moment the ship leaves the land, the builders cease to be competent to her control, and she passes at once to the hands of the seamen. Before launching, the sailors stationed on deck hasten to attach a small cable to some object on shore, and have it clear on deck for veering out; a small anchor, with a second cable, is also prepared to drop on the bottom. By means of this apparatus, when the velocity gained in descending the ways has declined, the ship is gradually checked, and at length drawn alongside of the wharf, which is to be the scene of her equipment. And now, while she is yet light and high out of water, is the most favour-

able time for shipping the rudder. The rudder is a machine placed at the stern of the ship, by means of which she is steered and turned about at pleasure; for by inclining it to one side, the passage of the water is there strongly opposed, which, checking the advance of that side, gives the other a rotary motion around it. It consists of two or more pieces of timber, of the thickness of the sternpost, of which, when not inclined, it seems a continuation. Narrow at the water's edge, where it might be endangered by the shock of a sea, and with it the very existence of the ship, it gradually increases in width towards the keel, where, from the nearly straight line in which the water reaches it, it exerts a more direct power to turn the ship. From forty to forty-five degrees is the most favourable angle for it to make with the keel, a greater serving rather to retard velocity than to cause rotation. To ship the rudder, it is only necessary o attach weights of iron to the heel, so that they may be loosed afterwards, and then sink it behind the sternpost, guiding it with ropes to the rudder-port, through which it is hoisted by means of sheers and tackle placed above. The pintals having caught the hinges or gudgeons on the sternpost, it is abandoned to their support, while a chock, placed above the upper pintal, prevents it from being unhung. A tiller, with ropes and a wheel, to turn

the rudder, completes the steering apparatus. Before raising the masts, it will now be well to take in ballast, especially if the ship be sharp. In every merchant-vessel, it is a good rule never to be without a small quantity of copper dross or shingle. And next, the sheers are got ready. They are two stout spars, having the large ends at the sides of the ship, the small ones being lashed firmly together, and overhanging the middle of the deck. They are lashed and rigged with guys and girtlings before being raised; the ends rest on the tafferel, and the tackle to be used in hoisting in the mast being taken forward to the windlass, serves to raise them. If it be necessary, a small pair of sheers are used to lift the ends until the angle be sufficiently open to give power to the purchase.* When erect, they are first placed over the hole for the mizzen-mast, and, if the ship be large, the deck should be shored up, to relieve it of the weight of the sheers and mast. Overhauling your tackle down to where the mast is on the wharf, or in the water, you lash the lower block securely to the front of the mast, just above the centre of gravity. With this, and a smaller tackle or gantling to the mast-head, the mast is taken up abaft the

* There is a variety of forms of rigging—ships, brigs, *brigantines, schooners,* sloops; but we shall only notice *the most perfect form,* called the ship.

sheers, until high enough, then lowered to its place, the step being tarred, and a piece of money thrown in for luck. The sheers are easily moved forward by their guys and tackles, the shoes in which their heels rest being greased, to slip over the deck. In this way the main and fore-masts are likewise taken in, and, the sheers being drooped over the bows, lastly, the bow-sprit.

There are various rules for sparring ships, all founded upon their length and breadth, which are the main elements of stability. It may be sufficient to name one simple rule for the length of the main-mast, this being the prime mover: Add the length at the load waterline to the main breadth, and take the half sum as the length of the mast. The top-mast may be three-fifths of the lower mast, the main-yard seven-eighths of the same, and so on upwards. The fore-mast may equal seven-eighths of the main, with upper masts and yards in proportion. The mizzen-mast, if stepped on the kelson, is five-sixths of the main-mast. The best rules on this subject are, perhaps, found in tables accurately prepared, in which the length of the masts are given in fractions of the ship's breadth, and those of the yards in fractions of the length. For the rest, it will be, in most cases, necessary to modify any *given rule*, in all instances, with immediate refer-

ence to the particular model of the ship, and to the uses for which she is destined. A vessel of war will have spars to spread sail to the full extent of her stability, while a merchantman will be sparred with reference to the limited force of her crew. As for the disputed advantages of long or short lower-masts, we agree entirely with Sir Cloudesly Shovel, who says, with equal wit and wisdom, "I mightily esteem short lower-masts; for, the shorter they are, the longer they will stand." With long top-masts you may make up an equal or even greater surface of canvass, far more advantageously spread, and more manageable, while it is procured at less expense, and with less weight aloft. It would be, moreover, an advantageous improvement in merchant-ships, not sparred to the extent of their capacity, to make the fore and main-masts, in all cases, of equal dimensions. With improved appearance, they would have all the respective spars and sails, except the courses, answering equally for both masts. This would enable them to go to sea with fewer spare ones, or to derive more advantage from the usual number. In small ships, all the spars are of single sticks of pine timber, which, for equal contents, are always stronger; but, for ships above six or seven hundred tons, it is impossible to procure *single trees* sufficiently large; and then it *becomes necessary* to resort to made masts (so

called) which are of oak and pine, very artificially put together, and bound with stout hoops of iron.

The spars of a ship are not abandoned to their own unsupported strength, but are sustained by what is called the standing rigging. This consists, for the bowsprit, of gammoning and bob-stays, confining it down to the stem, and shrouds, which sustain the immense lateral pressure which it endures when on a wind. The jib-boom and flying-jib-boom are, in like manner, supported by means of martingales and guys. The fore-mast is supported by three or four pairs of shrouds on either side, which set up to the channels, and by two stays led forward to the bowsprit. The fore-top-mast is supported by shrouds setting up in the top, back-stays descending to the channels, and stays leading to the bowsprit end. The top-gallant and royal-masts have also their shrouds setting up through the cross-trees, their back-stays descending to the channels, and their stays leading to the jib and flying-jib-booms. In like manner are the main and mizzen-masts supported, except that the main-stays set up on deck beside the heel of the bowsprit, the main-top-mast-stays at the head of the fore-mast, the main-top-gallant-stay to the fore-top-mast-head, and main-royal-stay to the fore-top-gallant-mast-*head*. The mizzen-stay also sets up beside the

main-mast, and the same in ascending. The running rigging consists of the tacks and sheets that serve to spread the sails, the halyards, braces, lifts, clewlines, and all other ropes used in making, taking in, or manœuvring the sails.

The sails of a ship are square sails bent to the yards, and fore and aft sails traversing on stays or bent to gaffs. Let us describe an entire suit, beginning forward: On the extremity of the bowsprit is the flying-jib, a three-cornered sail, which goes from the end of its boom upward along its stay, leading to the fore-top-gallant-mast-head, and confined to the stay by rings of wood or iron, called hanks. It is hoisted by means of halyards, hauled down by a downhaul; and, when up, is trimmed to hold the wind by a sheet leading to the forecastle. The jib, which leads from its boom to the fore-top-mast-head, is of similar form, and so is the fore-top-mast-stay-sail, running from the bowsprit end towards the mast head. On the fore-mast we have the fore-sail, bent to the fore-yard, and spread at the foot by means of tacks and sheets; above it, the fore-top-sail, bent to the top-sail-yard, by means of which it is hoisted aloft, while its lower corners are spread to the extremities of the fore-yard; next the *top-gallant-sail*, bent to its yard, and sheeting home *to the top-sail-yard*, and so with the royal and sky-

sail. All the sails are turned at pleasure, to be presented to the wind, by means of braces attached to their yard-arm, and leading to the main-mast. The main-mast is furnished with a similar suit of sails, somewhat larger; the mizzen also, though smaller than either, instead of a square-sail on the lower mast, it has a gaff sail, hoisting up and down abaft the mast. Some ships have similar gaff-sails on the fore and main-masts, which are found of great use in gales of wind, as a substitute for storm stay-sails. Most carry, also, light stay-sails between the masts; but they are very troublesome, and worse than useless. Studding-sails, or wings, as they are better called by the Spaniards, spread without the square-sails when going large, and are very useful. The perfection of equipping a ship with spars, rigging, and sails, consists in so disposing them, that, in a whole-sail breeze, the centre of effort of all the sails will be in the same line with the ship's centre of rotation; or that the efforts of the forward and after sails to turn the ship will be so exactly balanced as not to require any continued assistance from the rudder in either direction; for this, while it impedes her progress, does not leave the entire force of the rudder disposable, when necessary to turn. Of the two evils, however, seamen have more patience with a ship disposed to approach the *wind, than* with one needing the continued action

of the helm to keep her from falling off. The French helmsmen well characterise these two qualities by calling a vessel which has the first, ardent; the latter, cowardly. Like, however, cool courage between impetuosity and cowardice, a midship helm is still the golden mean.

Our ship is now completely equipped, and ready to receive cargo. Those articles with which a ship may be filled full are stowed with a single view to economy of space. Some, as cotton, require ballast; others, as staves, sugar and fluids, require none. When the articles are heavy and light, the heavier are placed nearest the bottom, to increase the ship's stability. When, however, all are heavy, there may be danger of making a ship too stiff; so that, not being balanced, she will roll violently, and, perchance, risk the fracture of a mast, or even spring a leak. To obviate this danger, the cargo should be raised; if iron, some should be stowed between decks; if coal or salt, it may be heaped up in the centre, taking care to secure it against shifting, should the ship be knocked down by a sea or squall. Heavy articles should never be placed towards the extremities, lest they promote pitching. In all cases, care must be taken to preserve the *trim of the ship*—that just proportion between her *draught forward* and aft, which the estimate of the

builder, or, when a voyage has been made, experience itself, has determined to be most favourable to rapid sailing.

The ship, being ready for sea, is usually dropped into the stream or roadstead. There she is confined by an anchor and cable passing through the hawse-hole at the bow, and clinched round the bits or windlass. As a vessel thus anchored is free to swing round at the will of wind and tide, she is liable to wind her cable round the anchor, and thereby entangle and change the position of its flukes so as to incapacitate it for holding her. To obviate this inconvenience, it is usual to moor with two anchors; one placed in the direction of the flood, the other of the ebb-tide. If there be no tides, the anchors are opposed to the prevailing winds, the heaviest being towards the most windy quarter, or the hawse open in that direction. Should a gale occur while thus moored, by veering out the cable which holds the ship, both may be brought ahead to act in concurrence. Care must ever be taken to keep the hawse clear for thus veering, that is, to prevent the ship from twisting her cables, by turning always the same way; or, when this unavoidably occurs, the hawse must be cleared by unbinding one of the cables, and carrying it round the other beneath the bow, until the turns be removed.

When about to sail, the hatches are carefully calked down and tarpaulined, except those necessary for the ascent and descent of the crew, and the boats are stowed. You may now unmoor, preparing the first anchor for letting go before taking up the second. If tending to the tide, with the wind fair to pursue your course, the last anchor may also be taken up and stowed before making sail. If, however, as is usual, your ship lie head to wind, stop heaving in when the cable is short, and proceed to make sail. The wind being moderate, the courses, top-sails, top-gallant-sails, jib and spanker may be loosed together; the top-sails and top-gallant-sails are sheeted home and hoisted up; and the other sails hang ready to be called into action whenever necessary. The yards are now braced ready to cant the ship. If you wish her to go to the right, the head-yards are braced with their right sides forward, and the after-yards the contrary way. Hence the wind, striking the fore sails obliquely on the left, tends to force them to the right; and, on the contrary, the after sails, being acted upon in an opposite direction, are forced to the left; but the fore sails are forward of the centre of rotation, while the after sails are abaft it; consequently, the efforts which they respectively exert will tend, the first to *force the ship's* head to the right hand, the others *the stern to the* left. The sails thus trimmed, now

heave up the anchor, profiting of the trifling advance through the water to turn the ship's head still more, and make the angle of the wind with the keel more open, by the action of the rudder. As soon as the anchor trips, and the wind begins to force the ship sternward, shift the rudder to the opposite side, that, by offering an obstacle on the left of the ship, the right side may turn backward round it more rapidly. This action of the rudder, in conjunction with the sustained effort of the sails to turn the ship to the right, and, presently, the addition of the jib, will gradually make the wind more and more open on the left bow, until at length it becomes sufficiently so to fill the after sails, which have hitherto lain aback. When this is the case, the fore yards are braced full, the spanker and courses set, and the ship immediately begins advancing. This mode of weighing is practised where there are other ships or a shore to leeward; otherwise, it is more common not to hoist the jib, or fill the fore sails, until the anchor is raised to the cat-head. The ship being under weigh, the time occupied in clearing the harbour is employed in stowing the anchors, unbending the cables—if the nature of the coast render it safe to do so—applying mats to the rigging and yards, to prevent chafing, *and in securing* the boats, water-casks, and whatever *other* movable objects might be in dan-

ger of starting by the pitching and rolling of the ship.

Our ship is now at sea, and it only remains to us briefly to explain the manner in which she is propelled and governed, and made obedient to her crew. There is no difficulty in conceiving how a ship may be made to move before the wind through a quiescent fluid like the sea. Let us suppose one at rest in a perfect calm, and equally pressed on every side by the gravitating action of the same fluid: she is maintained in equilibrio. But, by and by, a wind rising behind her, strikes her sails perpendicularly, and exerts a pressure in a single direction. As, however, the sails are attached to spars, and these in turn to the ship, it is evident that they cannot obey the impulse independently of the ship, but that all must move in unison; and the ship, being before pressed by the water equally, and maintained in quiescence, requires but a slight additional pressure in any direction to destroy her equilibrium. This pressure is abundantly supplied by the air of our atmosphere; for, though little more than a thousandth part of the density of the sea, it may receive a velocity enabling it to strike the sails with its particles in such quick succession as to *force the ship* forward with great rapidity, and, if *the resistance of* the water check her escape before

it, may even act with sufficient power to blow away the strongest sails, or even tear the masts out. Thus a beneficent Nature, in providing an element essential to our existence, by subjecting it to laws requisite for its healthy preservation, and forming a necessary link in the universal economy, has at the same time supplied an ever-active agent, which the ingenuity of man—an emanation of the same great Intelligence—has rendered subservient to the noblest purposes.

Conceiving, now, how it is possible for a ship to move freely before the wind, with a velocity determined by the force of that wind, the quantity of sail exposed to it, and the adaptation of her form to divide the sustaining fluid with the least resistance, we will now show how it is also possible for her to move in directions other than directly before the wind, and even to approach it. Let us suppose that the wind, at first dead aft, gradually veers towards the side until it blows at an angle of forty-five degrees with the keel. If, with the wind thus blowing, I still preserve my sails braced perpendicularly to the keel, it must necessarily strike their surfaces obliquely, dividing itself into two forces, one passing off to leeward, the other exerting itself in the direction of *the keel, and* therefore tending to propel her forward. *If,* however, in order to expose my sails

more fairly to the wind, I brace them forward until it becomes again perpendicular to their surfaces, the action of the wind on the sails is simple, but that of the sails on the ship is, in turn, compound, subdividing itself into forces; one acting to drive her to leeward in a direction perpendicular to the keel; the other, forward in a line with it. If, now, the ship were of a figure to move with equal freedom in any direction—round, for instance—it is evident that she would assume a mean motion between these two forces; but, being so formed as to divide the water with infinitely greater difficulty sidewise than forwards, the force exerting itself perpendicularly to the keel is neutralized, whilst that in a line with it, encountering an inferior resistance, compels the vessel to advance. We will next suppose the wind to have drawn forward until perpendicular to the course. The sails, being trimmed forward, so as to keep full, are struck obliquely, and, if the ship were again free to move in any direction, would impel her in a course perpendicular to its surface; but the portion of this force tending to drive the ship to leeward, being again encountered by the lateral pressure, is almost balanced; while, on the contrary, she freely obeys the force tending to propel her forward. Lastly, let us consider the situation of our ship when the wind gets before the beam, so as to make an angle of less than ninety degrees

with the course. It is evident that, if she still continue to advance, it must be towards the wind: this seeming paradox of a vessel approaching the wind by the very effort of that wind to drive it away, will still appear clear by the application of the same principles. To meet the emergency, let us now suppose the yards braced forward, until they make an angle of only thirty degrees with the keel; the wind being thirty further aft, will make an angle of sixty with the keel. In this position, the wind will strike obliquely on the after side of the sails; and though the greater part of the force passes off to leeward, there is still a partial effort to drive the sails in a direction perpendicular to their surface. This effort subdivides into two forces; one perpendicular to the keel, the other in a line with it: the first is nearly overcome by the lateral resistance; the second, encountering less, causes the ship to advance with a velocity proportioned to the smallness of the angle of incidence, and the disadvantageous application of the propelling power.

From what has been here stated, it would seem that, in theory, the situation of the wind most favourable to propelling a ship, is when it acts perpendicularly to the sails, and they in turn to the *keel; that is,* when dead aft. In gales of wind *this is likewise* true in practice; but in moderate

weather, a ship will sail faster with the wind on the quarter, or even abeam; for then the sails do not mask each other, but all receive the wind without interruption. On this account they more than make up the disadvantages of the unfavourable angle; of having the sails transported to leeward, by reason of which that side tends to advance faster than the other, to the disordering of the steerage; of the ship's heeling, and receiving the wind obliquely in the vertical direction; and, finally, of making her sail partially on one side, instead of on an even keel, as she is designed to do. On this account our sharp schooners will sail nearly or quite as fast on wind as off it, the sea being smooth and wind light; for, whilst all their sails act advantageously, by approaching the wind, they add to its force, instead of diminishing it, as when running from it. In square-rigged ships, bracing the yards correctly is one of the nicest points of seamanship; in general, the nearer the yards approach to being perpendicular to the keel, consistently with keeping the sails full, the greater will be the velocity.

But to return to our ship. It may chance that the wind does not stop at the exact point which would enable her, close-hauled, barely to go her course, but *even heads her off* so far that she can no longer *approach it nearer* than a right angle. It is evident,

now, that she is gaining nothing; but since she ca
sail within sixty degrees of the wind, by closin
with it on the other side, she may approach withi
thirty degrees of the desired course. Hence i
becomes essential to change sides. There ar
two ways of performing this evolution; the fir
consists in turning round towards the wind, and
called tacking; the second in turning before it, an
is called veering. As the first requires the ship
turn a much smaller segment of a circle, and mo
over maintains her head towards the desired cour
so that all her progress during the evolution is gai
and finally, since it is performed with greater ea
and expedition, it is always preferred when practi
cable. To tack, the crew are stationed at th
tacks, sheets, braces, and bowlines, ready to chan
the position of the sails. The ship being alread
close to the wind, the helm is gradually eas
down, so that the rudder may not exert its full for
until she begins to turn, nor act suddenly to chec
the headway, so essential to the success of the ev
lution; at the same time, the head sheets are flow
so as to cause the sails before the centre of rotatio
to shake, and lose their power of balancing the aft
ones. As the ship approaches the wind, the spank
is drawn gradually from the lee side towards th
centre, that it may keep full, and, by its action n
near the stern, continue promoting the rotatio

As soon as the sails reach the direction of the wind, and cease to draw, the corners of the courses are drawn up, and the tacks and sheets overhauled, ready to swing the yards. After a while, the sails catch aback, and the fore sails, soon masking the after ones, act with a powerful lever to turn the bow. At length, having come head to wind, without loss of headway, and the evolution being certain, the after yards are swung round ready to receive the wind on the opposite side; which operation is then more easily performed, from the sails being becalmed by the fore ones. Lastly, when the after sails are filled by the wind, the head yards are also braced round to receive its impulse, and the ship at once recovers its headway. Should she gather sternway before the sails become full on the new tack, the helm is shifted, that its action in a backward direction, instead of checking, may aid the rotation. There may, however, be occasions in which it is impossible to tack, either because the wind is not of sufficient force, or else so strong as to render it dangerous; then veering is resorted to. To veer, we put the helm hard up, brail the spanker, and shiver the after sails: in this situation the pressure of the head sails not being balanced by the after ones, tends, in conjunction with the rudder, forcibly to turn the ship. As she falls off, the after sails are still kept shivering until braced sharp on

the opposite tack; when before the wind, the spanker is set to aid the after yards and helm in bringing her to; the fore sails being squared, and gradually braced forward until the ship be by the wind again.

Thus easily is a ship manœuvred in fine weather; not unfrequently, however, a gale comes to disturb the peaceful course of the mariner, and call forth all his exertions. Let us suppose that, whilst our ship is contending against the head wind, the misfortune is augmented by its gradual increase. Shortening sail becomes necessary, and is determined by two leading considerations—the stability of the ship, and the strength of her masts: it is to diminish the careening of the one, and avoid endangering the other, that the surface spread to the wind is reduced. In shortening sail, we always begin with the highest and lightest sails, descending gradually, and keeping pace, in an inverse ratio, with the increase of the wind. The sails do not, however, come in uniformly in the direction of the length; but the after sails most rapidly; because, as the wind increases, the energy which it exerts in a forward direction upon the masts, tends, with a powerful lever, to depress the bow and raise the *stern; hence* the latter drifts more easily to leeward, *thereby bringing* the bow towards the wind; this

effort is also promoted by the action of the sails passing further to leeward, and by the ship ceasing to sail on an even keel. From all these reasons, the more the wind increases, the more she tends to come to; so, to avoid a constant recurrence to the action of the rudder, it becomes necessary to shorten sail faster aft than forward; taking in the mizzen-top-gallant-sail, and even the spanker, before the fore and main-top-gallant-sails: for the same reason, when it becomes necessary to reef, it is not unusual to begin with the mizzen-top-sail. Reefing consists in binding a portion of the sails to their respective yards, so as to reduce the surface. To reef the top-sails, we clew the yards down, haul up the sides of the sails by means of reef-tackles, and brace the yards to the wind, until the sails shiver and spill; then the men go out on the yard, and, by means of the earings and reef-points, securely bind the requisite portion. When the top-sails are double-reefed, it is time for the jib to come in to relieve the jib-boom and fore-top-mast of the pressure: to counterbalance the loss of this head sail, the mizen-top-sail may be furled. When the top-sails are close-reefed, the main-sail is either reefed or furled. As the gale increases, furl the fore-top-sail; taking care to draw up the *weather-clew first*, that the sail may not be in danger *of shaking* and blowing away. Our ship is now

under reefed fore-sail, main top-sail close reefed, fore-top-mast-stay-sail, and storm stay-sails: these are stout triangular sails, running in the direction of the fore, main, and mizzen-stays; they are often advantageously replaced by gaff-sails, which are similar to the spanker. Should it blow still harder, it may be necessary to take in the fore-sail, replace the fore-top-mast by the storm stay-sail, and even furl the main-top-sail. The ship now drifts much, and tending to fall off, from her greater draft abaft and consequent resistance of the water, will require the reefed spanker, and even the continued assistance of the rudder, to keep her to: the helm being kept constantly hard down, she is said to lie to. This is the way in which most ships make the best weather; some, however, tend so much to fall off into the trough of the sea, as to be in perpetual risk of being boarded by the waves, (which wash the boats and other movables loose, sweep the crew overboard, to creep up the side again by the channels, or find a watery grave,) and, if the hatches be not well secured, of having her existence fatally endangered. In this case, it may become necessary to bear up and scud. To do this with least risk, it is necessary to show the head of the fore-top-mast-stay-sail, or part of the fore-sail or fore-top-sail; taking advantage of a momentary lull *and smoothness* of the sea to bear away. The

ed by the sea, and is therefore a good
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for ever, with all her treasures of pro
life; oftener, however, the elements be
with their own violence, and man rer
iant; the gale abates; the mariners
, send up the mast and yards which
used and taken down on the approach o
t; the reefs are all shaken out, and s
to keep the ship from labouring in the
waves. Hope mounts with the ascer

canvass, the sea foams beneath the bow, and we bound merrily towards the land.

And are we not justified in expressing our admiration at this great achievement of man—the production of this wonderful machine—the most complicated, most perfect, sublimest of all the works of art? If it be well said that man is the noblest work of God, it may with equal truth be asserted that the ship is the noblest work of man. Our language has indeed done well in awarding to her the honours of personification. It were a vain task to attempt enumerating the various geometrical problems involved in her design, or the multiplied mechanical principles combined in her construction. Let us only, forgetting all we know, endeavour to realize the immeasurable distance and difficulties between the trees growing in the forest, the iron and copper buried deep in the bowels of the earth, the hemp and flax waving in the fields, the tar sealed up in its timber, and the actual achievement of the sailing ship! Yet a very short time—a single month—suffices to transform these rude productions into the magnificent machine, which, notwithstanding its mountain-form, obeys each command of the mariner; goes from the wind, towards it, halts, or redoubles its velocity, obedient to his voice: in which he launches boldly

NAVIGATION.

ORIGIN OF THE ART—QUALIFICATIONS OF THE AN PILOT—MANNER OF PERFORMING A VOYAGE—RELIGIOU SERVANCES—CARTHAGINIAN NAVIGATORS—CONDITION O ART IN THE DARK AGES—DISCOVERY OF THE POLARI THE MAGNET—PRINCE HENRY OF PORTUGAL—COLUM NUNEZ—INVENTION OF LOGARITHMS—OTHER IMPROVE — VARIOUS INSTRUMENTS USED IN NAVIGATION—A PRACTICE OF THE ART.

HORACE has well said, that his heart must r have been bound with oak and triple brass, first committed his frail bark to the tempest sea. Nothing, indeed, conveys a higher ide human daring than the boldness with which rushes forth to encounter the elements; not speaks louder in praise of human ingenuity than wonderful art by which he is enabled to forsak land stretching forth until it fades from the hor and nothing visible remains but the hollow hea above, and a trackless waste below; driven his course by adverse winds, yet, by dint of p verance, wearying out the elements; and at le *arriving*, with unerring certainty, at the haven v

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ORIGIN OF THE ART—QUALIFICATIONS OF THE ANCIENT PILOT—MANNER OF PERFORMING A VOYAGE—RELIGIOUS OBSERVANCES—CARTHAGINIAN NAVIGATORS—CONDITION OF THE ART IN THE DARK AGES—DISCOVERY OF THE POLARITY OF THE MAGNET—PRINCE HENRY OF PORTUGAL—COLUMBUS—NUNEZ—INVENTION OF LOGARITHMS—OTHER IMPROVEMENTS—VARIOUS INSTRUMENTS USED IN NAVIGATION—ACTUAL PRACTICE OF THE ART.

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he would be. And if the daring and ingenuity of the navigator deserve our admiration, the result of his efforts will not appear unworthy of the means. It is to the exercise of his wonderful art, that we are indebted for the improvement of our condition, which arises from the exchange of the superfluity of one country for that of another, the whole world being penetrated, and every clime made tributary to every other, until the whole globe is reduced to one common country. Above all, to navigation are we indebted for that higher and nobler advantage,—the interchange of sense and sentiment, which makes wisdom common to the world, and urges man onward to perfection.

Yet it has not always been so. Time was when the canoe, or the raft, constituted the only ship of the sailor, and when the narrow precincts of a lake or river set bounds to his roving disposition, and confined him within view of familiar objects. Advancing a step further, we find him venturing from headland to headland, or from island to island, with a view of gratifying his curiosity, or bettering his condition, until a gale, driving him to some unknown coast, increases at once his knowledge and hardihood. Meantime, his bark adapts itself to nobler functions, enlarges its size, and improves in form; the rudder is added,

the mast is better sustained, and the sail receives a more favourable application. And thus the art by which the ship is made, and that by which it is conducted, advance with equal steps. Deprived of the aid of surrounding objects, the land withdrawn from view, and nothing within the verge of the horizon but a waste of trackless water, the mariner casts his eyes in despair to the overhanging heavens. Aid is granted to his prayers: the constellations assist him in his course: among many revolving stars, he finds one steadfast, and makes it his perpetual guide. Such do we find the actual state of navigation among the savage tribes of our own day; and such was also the progress of the art among the earliest nations that improved it. Not the least of the improvements which we have made in this art, is that simplification in practice, by which it is rendered available with little study and capacity.

Anomalous as it may seem, yet it is true, that more study, more experience, and laboriously acquired information, were necessary to form an Acestes, or a Palinurus, than are now required to furnish forth a La Perouse or a Parry. The master, or pilot, of ancient times, who had command of the sailors, and directed all the evolutions, was not merely required to know whatever related to *the* management of the sails, the oars, and the

rudder: he was to be familiar with all the ports that lay in the track of his navigation, the landmarks by which they were designated, and all the rocks, quicksands, and dangers of the intervening deep: he was to know the course of the winds, and the indications which preceded them; also the movements of the celestial bodies, not merely for the purpose of directing his course by them, but to understand the winds and weather, which some of them, as Arcturus and the Dog-star, were believed to portend. Moreover, he had to be skilled in reading the various omens, which were gathered from the sighing of the wind in the trees, the murmurs of the waters, and their dash upon the shore; the flight of birds, and the gambols of fishes. A voyage was, in those days, a momentous and awful undertaking. When the time arrived for the sailing of a ship or fleet, the masts were raised, the sails bent, and all made ready with solemnity, and great parade of preparation. If, as was most usual, the ships were hauled up on the shore, the mariners placed their shoulders at the stern of the ships, and, at the word of command, pushed their bows forward into the sea, leaping aboard when they floated. Levers were used to move the heavier vessels, and, in later times, the helix, (probably, jack-screw,) which Archimedes had invented for that purpose. *Before putting* to sea, the gods were ever solemnly

invoked, and propitiated by numerous sacrifices; thus we find all Homer's heroes sacrificing to the gods before they undertake a voyage; and Virgil's Anchises ventures forth only after having devoted a bull to Neptune and a bull to Apollo.

Nor did the voyagers alone supplicate protection: the crowds of friends and countrymen, who thronged the shore, joined fervently in prayers for their deliverance from danger, and, like the Venusian poet, commended their departing friends to the presiding deities of the winds and waves. All omens were carefully regarded; the entrails of the sacrifices examined, with every possible prognostic of good or evil; and a very small matter, the perching of swallows on the ships, or an accidental sneeze to the left, was enough to delay departure. As this, however, never took place without the most favourable auspices, it was always joyful. The ships were adorned with streamers and garlands of flowers; and, when the signal was given from the admiral ship, by sound of trumpet, a shout of rejoicing rang through the fleet, sent back by the responding blessings of the friends that remained. After advancing a short space, doves, which the mariners had brought from their homes, were released, and their safe arrival—not unfrequently charged with the last adieu of a departing lover—

was considered auspicious of the return of the fleet. The admiral led the van, conspicuous by his painted sails and streamers, and opened a path in which many followed. In moderate weather, the ships often sailed side by side; but, as the wind freshened, and the sea grew rough, the order became more open, to avoid contact. At all times, they kept close to the land, following the indentations of the coast. When night approached, it was customary to anchor, or else to beach the vessels, that the crews might repose, each rower sleeping on his bench, ready to renew his labours with the returning sun. If the amenity of the weather, the friendly aid of the moon, or the open nature of the navigation, admitted of sailing during the night, the plummet or the sounding-pole directed their course, or it was shaped, as by day, from headland to headland. If the land were not visible, the known direction of the wind continued, with the aid of the stars, to guide them. Cynosura was the favourite star of the Phœnicians: the Greeks abandoned themselves to the direction of Helice.

Having escaped the multiplied dangers of such a navigation, and having accomplished their object, the ships returned home with songs and rejoicings. If they were to be stranded, the sterns were turned towards the shore, and the vessels forced back-

wards upon it with the oars, until the crew landing, drew them beyond the reach of the surf. Sometimes they were taken into the beautiful moles, or artificial harbours, which the ancients constructed, with great labour and ingenuity, within the natural ones. These were in the shape of crab's claws, or horns, the ends, which formed the entrance, so overlapping as to exclude the swell of the sea. Castles defended their approach, and a light-tower, placed at the entrance, guided those who sailed along the coast, or desired to enter by night. It was called Pharos, from the island at the mouth of the Nile, where the first tower had been erected. Here the vessels were not hauled up, but simply fastened to the rings, or pillars, provided for the purpose, while at the inner port were docks and stores for building and repairing. In this port, too, were temples devoted to the gods, and especially to the patron of the place, where propitiatory sacrifices were made, and vows fulfilled or recorded; here, too, were numerous taverns, and places of more licentious gratification. Whether, however, they stranded their vessels on the beach, or moored them in the harbour, the mariners, before repairing to these resorts, fulfilled the vows made before departures, or in seasons of peril, offered thanks to Neptune, and sacrifices to Jupiter, for having granted them release from the durance of

their ships. Upon those who had escaped shipwreck, gratitude was more deeply incumbent. In addition to other sacrifices proportioned to their means, they usually offered the garment in which they were saved, together with a picture descriptive of the disaster. If nothing else remained to them, the hair was shorn from the head, and consecrated to the tutelar deity; hence offering the hair was the last vow of the distressed mariner.

There is much that is beautiful in these simple acts of piety; but, except in some Catholic countries of the Mediterranean, where pictures of rescue and garments are still hung before the shrine of an invoked intercessor, and where processions are still made, after escape from shipwreck, none of these touching customs now remain. What can be more beautiful than the grateful sense of divine interference with which Columbus and his followers hasten to fulfil their vows after their safe return to Palos? Such piety, if it availed not to avert present danger, at least served to inspire confidence to meet it; and, when past, the gratitude which it occasioned must have tended at once to refine the sentiments and ennoble the heart.

Imperfect as were the means and knowledge of *the ancients* in this noble art, yet the Carthaginians,

who superadded the greatest commercial enterprise to the greatest skill which had yet been attained, achieved results which may even now be esteemed brilliant. They made the whole of the old world tributary to their city; not contented with exploring every nook and corner of the Mediterranean, they left behind the *ne plus ultra* which had hitherto almost entirely bounded the excursions of their predecessors, visited the Atlantic coasts of Europe, the British isles, and pursuing the grand idea which afterwards led the Portuguese to India, discovered a vast extent of the western coast of Africa. Pliny even states that Hanno completed its circumnavigation, and returned home by the Red Sea. Had not Carthage prematurely fallen beneath the rivalry of a nation braver and more barbarous, Vasco da Gama might have had to seek laurels elsewhere than by sailing first to India, and even Columbus been spared the most brilliant and enviable of all the achievements of navigation,—the discovery of the New World. The art of navigation gained nothing after the fall of Carthage; and the invasion of the northern barbarians effectually extinguished the few gleams of science which had survived her catastrophes. Every thing remained stationary for centuries, until *the returning* day of civilization began once more *to dawn* upon the world.

It was not until the close of the twelfth century, that man became sensible of the existence of the most singular property which an all-wise and all-beneficent Creator has provided to be his guide upon the deep; nor until a still later period, that the genius to improve it—the gift of the same good Being—at length rendered it available to so noble a purpose. We allude to the polarity of the magnet, and the invention of the mariner's compass. The property of that mysterious mineral to attract iron was early known to the Greeks and Chinese; but the far more singular one of assuming a particular direction, was not even suspected. Pliny himself, who records every thing known or fancied in his time concerning the magnet, makes no allusion to its polarity. The first accounts of this speak of it as known in the twelfth century, and that mariners sometimes made use of it to ascertain their course. Of the mariner's compass, we can only say that it was either invented or revived in 1302, by one Flavio Gioia, an obscure individual in the kingdom of Naples; and even this is not known with certainty. While the heroes of the remotest times come down to us, not only with an accurate account of battles fought and thousands slain, but with a minute detail of their private lives, and most insignificant peculiarities, posterity is at a loss to know whom to bless for a recent discovery, of all others the most useful in its results, the most

important in its influence upon the destinies of man.

The effects of this discovery upon navigation were not, however, immediate; for the mariner, as much as any one the slave of habit, could not at once appreciate and confide in the excellence of his new guide. This is the only excuse for the uncertainty which hangs about the identity of the discoverer. The experience of half a century, however, showed the value of this new assistant. Navigation now assumed a bolder character. Prince Henry of Portugal, son of king John, having gained a brilliant reputation in a war with the Moors, turned from these fierce pursuits to the more congenial one of science. Retiring from court, he established himself in a retreat upon the promontory of St. Vincent, and, calling round him astronomers and mathematicians from every nation, he collected and systematized all the science of the day. Nor were his researches of a mere speculative character; they were directed to enlighten the field of discovery in which he was engaged, in search of a nearer route to India, and which, though he attained not the grand object of *his ambition*, repaid him well by the inferior *discoveries* to which it led. It was to aid these *enterprises* that he caused charts to be drawn

which though they involved the monstrous supposition of the earth's being an extended plane, were of no inconsiderable use to the navigator, as they brought together whatever was known of the relative position of the different points of the earth, and enabled him to see at a single glance, as in a picture, not only the direction of the port which he desired to visit, but also the various coasts, rocks, and quicksands to be avoided in the way. He also invented the astrolabe, which was simply a quadrantal arch, graduated at the rim into degrees and half degrees, and by directing one edge of which towards the heavenly body whose altitude it was desired to measure, a plummet suspended from the centre was made to mark the angle of elevation. This was used at first to discover the latitude from the elevation of the polar star: for, as that star is in the horizon when viewed from the equator, and rises gradually in approaching the pole, so that it would at length become vertical, it follows that the elevation is always equal to the observer's distance from the equator, which is the latitude. The error resulting from the star's being not exactly polar, was of little note in those primitive days of the art. Soon after, by causing tables of the sun's declination to be computed, Prince Henry enabled the mariner to deduce his latitude more correctly from the meridian altitude of that star,

Yet all these improvements, though they added much to what was already known, left the art in its infancy. Columbus was the most accurate navigator of his day; still we find him often making an error of so many degrees in his latitude, that the mistake of an equal number of minutes would not be excused in a modern navigator. To mention one of many instances, — he places San Salvador three degrees north of its true position. But if Columbus made his discovery with such imperfect means, the greater was his merit: to him belongs the credit by pushing boldly forth amid the uncertainties of the ocean, of forcing navigation, as well as ship-building, to provide against new difficulties, and march rapidly onwards in the career of improvement. From the moment that the hitherto hidden mysteries of the ocean were thus solved, we find improvements and inventions multiplying in rapid succession: first, the log is introduced, to measure the ship's rate of sailing: Nunes, a Portuguese mathematician, next shows that the shortest distance from place to place upon the surface of the globe, must always be along a great circle of the sphere: he also proves the fallacy of the plane chart: Gerard Mercator, a Fleming, next suggests the idea of extending the meridian lines on the plane chart, in receding from *the equator, in* a ratio equal to the error occasioned *by supposing* the meridians parallel, instead of

gradually converging as they do towards the poles. By this means, the advantage of a plane surface was retained, without the error of the old chart, or the inconvenience and imperfection of the globular projection. Wright, an Englishman, improving the suggestion of Mercator, calculates a table of meridional parts, increasing the length of the arches of meridians in due proportion towards the pole, and furnishes, thereby, data to determine, in any latitude, the difference of longitude from the departure, or distance sailed east or west. At the same time, Lord Napier's invention of logarithms wonderfully diminishes the labour of calculation, enabling the mathematician, by their help, to substitute for the tedious operations of multiplication and division the simpler ones of addition and subtraction. Now, too, Gunter presents the seaman with his admirable scale, containing the logarithmic lines, by aid of which and a pair of dividers, all the problems of geometry are easily and accurately performed. The circumference of the earth is ascertained by measuring a given portion of its arch; and, the length of a degree being known, the log-line is marked accordingly. The quadrant, or rather octant, is invented, and measures the altitude of the heavenly bodies to the nearest minute, undisturbed, like the astrolabe, by the motion of the ship. The sextant and circle still improve upon the octant and each

other. And now the tables of the moon's motions, invented by Mayer, with a view to ascertain the longitude, are improved by Maskelyne, and published periodically at the expense of the British government.

The idea of finding the longitude by the watch had been early suggested as an important use of that admirable machine; but it continued too imperfect until the last century, when the munificent rewards offered by Britain so stimulated mechanical ingenuity, that it has at last become admirably adapted to this important purpose. To those who are ignorant of the means by which men are enabled to trace their way over a trackless deep, and to whom the whole art is a mystery, it may be interesting to learn how seamen, and often very ignorant ones, are able successfully to practise it. We shall, therefore, in conclusion, briefly explain the actual practice of navigation: and, first, it may be necessary to premise that, in order to determine and designate positions on the surface of the globe, latitude and longitude have been invented. Nor is this system entirely arbitrary, since nature herself furnishes the data. We have the poles, determined points of that axis round which *the earth performs* its daily revolutions; equidistant *from these poles*, and midway between them, nature

aids us to conceive a line called the equator, and about which, by the motion of the earth in its orbit, the sun seems to perform an equal movement, accomplishing the beautiful scheme of the seasons by an annual excursion on either side.—What idea more obvious, and, at the same time, more beautiful and complete, than that of measuring latitude from the equator towards the poles, upon meridional lines perpendicular to it, and formed upon the surface of the earth by planes of its axis? But the latitude, though it indicates the distance from the equator, does not alone determine the position; for the same latitude may correspond to an infinity of places, except only a latitude of ninety degrees: hence, then, the necessity of longitude, measured round the world upon the equator, and small circles parallel to it; for, crossing each other at right angles, the same latitude and longitude can only concur at one given point.

Latitude and longitude are measured in degrees, minutes, and seconds; the first, from the equator to the poles, a quadrant of ninety degrees; the second, from the first meridian east and west, a semi-circle, or 180 degrees, and meeting at the antipodes. In this there are two things deeply to be regretted: one is, that the circle had not been divided into *400 degrees*, instead of 360, each quadrant being

of 100 degrees, and each degree further s
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national vanity.

Let us now show the means by which
riner guides his bark across the ocean
able, at all times, to determine his prog
position. The most important instrum
by the navigator is the compass. It cons
magnetized needle, freely suspended, by
or metal socket at its centre, upon an
spindle, and possessing the singular pro
pointing to the poles. The magnetic virtu
municated to the needle, which is a flat
piece of hard steel, by applying a natural

cial magnet to its two extremities. The magnet has two distinct properties, corresponding to its two extremities or poles, the one called boreal, the other austral magnetism, and which have a near analogy to the equally mysterious principles of positive and negative electricity. When, then, the poles of the magnet are applied respectively to the intended poles of the needle, magnetic influence is developed, not imparted; for the magnet, instead of losing virtue, has itself gained a new accession; and the needle assumes the wonderful power of pointing to the poles of the earth. Attached to the needle is a circle of paper, called the card, upon which the points of the compass are marked, the north and south points corresponding to the poles of the magnet, with which it revolves. The spindle rises from the bottom of a brass or wooden hemisphere, called the shell; this shell is connected to the compass-box by means of two concentric rings, or jimbals, which allow it to swing freely as the ship rolls and pitches, so as to maintain a perpetual level. The box, in turn, is placed within the binnacle, which stands in front of the helm.

It were vain here, or any where, to speculate upon the cause of magnetism. We are acquainted, indeed, with the effects of the phenomenon, but all *beyond continues* to baffle the search of science.

It only becomes us to avail ourselves of its guidance, with humble and devout thankfulness for a gift obviously bestowed to open to us the highways of the deep. Having in the compass an instrument for directing our course, we next seek the means of ascertaining the distance run. This we find in the log. The log is a long cord, having a piece of wood attached to one end, and called the chip. This is of a quadrantal form, and being slung at the corners with line, and loaded at the circumference, when thrown overboard, it remains erect and stationary, and drags the line off as fast as the ship passes through the water. The line is divided into knots and half knots, representing miles and half miles, or minutes of a degree to which they bear the same proportion as the log-glass does to an hour. Thus the log-glass being filled with sand, to run through in 30 seconds, the length of a knot must be 51 feet, the first being the same proportion of an hour, that the last is of a mile. As, however, the log is found to come home a little in the effort to draw the line out, it is customary to mark the knot a foot or two less than the true length.

The mode of heaving the log to measure a ship's *rate, is as follows*: the log-reel upon which the *line is wound* being held by one of the sailors, the

officer places himself on the rail to leeward, and a third person holding the glass, he proceeds to prepare the chip, so that the peg of one of the lines holding the chip in a perpendicular direction, will draw out, by the force of the water, when the reel is stopped, and allow it to haul in easily. Then, having gathered a sufficient quantity of line into his hand, he throws it far to leeward, that it may not be affected by the eddies which follow in the wake. The stray line, which allows the chip to get astern, now runs off, and the instant that the white rag, which marks its termination, passes through the hand of the officer, he cries, "Turn!" and continues to veer out line until the glass runs out, and the person holding it cries, "Stop!" Then the line is grasped, and the number of knots that have passed off mark the speed of the ship. When this exceeds five miles, it is usual to use a glass of 15 instead of 30 seconds, counting the knots double. The rate of sailing, per hour, multiplied by the hours sailed, thus gives the mariner the measure of his run.

In addition to these essential instruments for directing the course and ascertaining the distance, the navigator must be provided with octants of double reflection, to measure the altitude of the heavenly bodies; and a circle, or sextant, more nicely graduated, to measure distances between the moon

and stars. He should also have with him a book containing the logarithms of numbers, sines, tangents and secants, to facilitate trigonometrical calculations; tables for correcting altitudes for dip, parallax, and refraction; also lists of latitudes and longitudes for every part of the world; and of time of high water at every port, at the period of full and change of the moon, from which, at all times, to be able to find the tide; and a variety of tables, to facilitate the various problems of navigation. He should also have with him the Nautical Almanac, containing the places and declinations of the fixed stars and planets, and especially the distances of the moon from the sun and other stars, and all that relates to that body, with a view to calculate the longitude by observation. Finally, he must be provided with the general and local charts applicable to his contemplated voyage. Thus furnished, the mariner may set sail with confidence; many do so with no other aids than their compass, log, quadrant, a single chart and book of navigation, and arrive in safety.

But it is less our business to show with how little care a ship may be navigated, than to show how she may be carried from port to port with *the greatest* possible certainty. Having taken *leave of the* port, and, when the last land is

about to disappear from view, either from the growing distance or the intervention of night, the mariner selects some conspicuous headland, of which the latitude and longitude are noted in his tables, and, placing a compass in some elevated position, remote from any iron object to disturb its polarity, proceeds to determine its bearing, and estimate his distance from it, either by the progress made from it, or by the ready estimate of a practised eye. Or, taking the simultaneous bearings of two distinct points of coast, he has still surer data for deducting his position. This is called taking the departure, and is carefully noted on the log-slate, with the time of making the observation. Thenceforth the log is thrown every hour, and the course and distance are entered upon the slate, to be copied into the log-book at the end of the day. The first thing which the navigator attends to, after making the offing which prudence dictates to clear the dangers of the land, is to shape his course for the port of his destination. And first he searches in the chart if there be any point of land, island, or rock, intervening in his way. If there be, the course is primarily shaped with reference to the danger; if not, the differences of latitude and longitude between the two places being taken, the course and distance are obtained by the aid of *trigonometry*. The shortest distance between any

two places on the surface of our sphere, is the arc of a great circle passing through those two places. Thus, between Cape Henry, in latitude 37°, and the island of St. Mary, in the same latitude, but 50° lon. further E., the distance is 30 miles less in sailing on a great circle, than if you were to sail due E. on a parallel of latitude, and consequently on a lesser circle of the sphere. In a higher latitude the difference between sailing on a great or small circle becomes more considerable, as the small circles grow smaller; thus, in the latitude of 60°, a distance equal to that between Cape Henry and St. Mary would offer a disparity of near 200 miles.

But, as it is only in sailing on the equator, or on a meridian, that the compass points are uniformly along a great circle of the sphere, in most cases it would be necessary to change the course at short intervals, in order to attain even an approximation towards this desideratum. For instance, in sailing from Cape Henry to St. Mary, on a great circle, it would first be necessary to sail more than a point northward of E., gradually approaching that direction towards the middle of the distance, when the course should be due E.; thence declining southward, until the land would be made upon a course as much south of E. as, on starting, it was north of it. In high latitudes, when the re-

duction of distance would offer a sufficient inducement, it may be advantageous to attempt following a great circle; but in the seas ordinarily traversed by mariners, the trifling increase of distance which results from following a uniform course, as obtained by Mercator's sailing, is far more than compensated by its convenience and freedom from all perplexity. For the rest, the wind not unfrequently deprives the fastidious navigator of all choice between a great circle and a loxodromic.

At the first noon succeeding the time of taking his departure, the mariner works up his reckoning. This is an epoch fixed by nature, being determined by the passage of the sun over the meridian, and is therefore well chosen as the beginning of the day. The log-slate being marked, he copies the courses and distances, if from head winds or other cause they have been various; the departure from the land is also converted into a course; as is also the current, if there be any known one. He next proceeds to find the difference of latitude and departure from the meridian corresponding to each course either by geometrical calculation, or more expeditiously, by reference to tables; then he adds the several differences of latitude and departure, and, if they be of different names, as some north and some *south, some* east and others west, deducts the less

from the greater. With the remaining difference of latitude and departure, he not only finds the course and distance made good, but also the latitude and longitude in; the difference of latitude being applied to the latitude left, by adding or subtracting, in sailing from or towards the equator, at once gives the latitude of the ship.

But before the departure can be thus applied to find the longitude, it is necessary to reduce it for the converging of the meridians towards the poles; for though all degrees of longitude are divided, like those of latitude, into 60 minutes or miles, yet they decrease in length, from being equal to a degree of latitude at the equator, until they become nothing at the poles. There are many ways, more or less accurate, of deducing the difference of longitude from the departure, the latitude being known; they are founded upon this principle: the circumference of the earth at the equator is to its circumference at any given parallel of latitude, as the departure is to the difference of longitude. The most easy and correct way of obtaining the difference of longitude, on an oblique course, is by the aid of a table of meridional parts; for having taken out the meridional difference of latitude, the mariner has this simple proportion: the proper difference of *latitude* is to the meridional difference of latitude

as the departure to the difference of longitude. The difference of longitude thus obtained, is applied to the longitude left, adding or subtracting, in sailing to or from the first meridian, and the result will be the ship's longitude; which, with the latitude previously ascertained, determines her position on the chart. The method of navigating thus described is called dead reckoning. It is far from infallible, and leaves much to desire. It will, indeed, do pretty well in short runs; but as errors daily creep in from many causes escaping calculation, such as bad steerage, leeway, heave of the sea, unknown currents, and as these accumulate, and become considerable at the end of a long voyage, it becomes necessary for the mariner, removed from all reference to terrestrial objects, to resort to the immovable guides in the heavens, whose motions, the God that placed them there has given him capacity to comprehend.

Let us now see how the ship's position on the ocean, represented by latitude and longitude, may at any time, without reference to course sailed, or distance, to capricious winds and stealthy currents, be ascertained with ease and accuracy. And, in the first place, to find the latitude, we have abundant data. All the heavenly bodies are, by the *revolution of the* earth, daily brought to the meri-

dian, at which time, if their altitude be measured, their declination or distance from the equinox being known, the latitude is readily deduced; it may also be deduced from single or double altitudes of bodies not in the meridian, the times being accurately known. But the meridian altitude of the sun is what furnishes at once the easiest and most correct method of finding the latitude. The meridian altitudes of the stars, and frequently of the moon, must be taken at night when the horizon is vaguely marked; moreover their minuteness and want of brilliancy make observation troublesome and uncertain; but when the sun comes to the meridian, the observer brings a brilliant and palpable object down to a well-defined horizon; then, too, he has the advantage of observing, at a self-fixed epoch, the beginning of a new day. So great, indeed, are the advantages offered by the meridian altitude of the sun, that no other means of finding the latitude are used, except when these have failed from a clouded atmosphere, or when the momentary expectation of making the land quickens the mariner's anxiety.

We shall, therefore, now explain the method of deducing the latitude from the sun's meridian altitude. Furnished with a sextant, circle, or octant *of reflection*, the observer goes upon deck, and, *having examined* the adjustment of his instrument,

proceeds to bring down the image of the sun reflected by its mirror, until the lower limb just sweeps the horizon. He continues to follow and measure its ascent, until it ceases to rise; the moment that it begins to fall, and the lower limb dips in the horizon, the sun has passed the meridian. The altitude marked by the index being read off, it is next corrected. And first the observer adds the semi-diameter, in order to make the altitude apply to the centre of the object; next, he subtracts the dip, to meet the error caused by the extension of the horizon, in consequence of the rotundity of the earth, and the elevation of his eye above its surface; also the refraction of the atmosphere, by which the object, when not vertical, is made to appear higher than its true place; lastly, he adds the parallax, (a small correction, inconsiderable from the sun's distance,) in order to reduce the calculation for the centre of the earth; from which point all calculations are made, and which is ever supposed to be the station of an observer. Having made all these corrections, which many mariners dispatch summarily, by an addition of 12 minutes, he has the true meridian altitude of the sun. Taking this from a quadrant, or 90 degrees, gives its zenith distance or distance from that point in the heavens which is immediately over the observer, and would be met by a straight line passing from the centre of

the earth through his position. Now, if the sun were for ever on the equinoctial, the zenith distance would always be the latitude; for, whilst the zenith is the observer's position, referred to the heavens, the equator is there, in like manner, represented by the equinoctial; and we have already seen that latitude is the distance from the equator. But, as the sun is only twice a-year upon the equinoctial, and as his distance from it, at times, increases to more than 20 degrees, it becomes necessary to take this distance, called his declination, into the estimate. The sun's declination is given in the Almanac, for the noon of each day; by correcting it for the time anticipated or elapsed, according as the sun comes first to him or to the first meridian, by his position east or west of it, the observer obtains the declination for noon at his own position. This declination applied to the zenith distance, by adding when the sun is on the same side of the equator, by subtracting when on the opposite side, gives the true latitude. A daily and accurate knowledge of his latitude is, then, to the mariner of our day, a desideratum of easy attainment. By its aid, nothing is easier than to sail clear of any rock or shoal that crosses his track, either by a watchful look-out at the moment of *passing its* latitude, or else by avoiding his parallel *entirely, until it* be surely passed. Moreover, this

is his best and surest guide in aiming at his destined port; for he has but to attain the exact latitude it lies in, and then sail directly upon it, east or west, to be sure of success. And here nature is again his friend: by a singular coincidence, discoverable in glancing at the map of the world, most coasts and continents lie in a northern and southern direction. Hence the value, attached by seamen, to an accurate knowledge of the latitude: and hence the saw of "Latitude, lead and look-out."

But if it be possible to obtain the longitude with anything like an equal ease and certainty, no one will dispute its advantage. Although, as we have stated, most coasts follow a northern and southern direction, there are yet not a few, such as both coasts of Cuba and San Domingo, which lie east and west, so that points along them are only determined by the longitude. And even to have the satisfaction, not merely to run his finger along the chart, and say, "I am somewhere along that parallel," but to be able to point to the spot and say, "I am there," is, to the nice navigator, no insufficient motive. Various ways have been devised to find the longitude, in all of which the great element is time. Inasmuch as the earth performs her diurnal revolution in 24 hours, from the time any given meridian is brought under the sun, until it reaches

it again, it follows that 24 hours and 360 degrees are both equal to a circle, and that the equator and other circles of longitude may be indifferently estimated by either of these divisions. Hence the difference of time between two places, is no other than the difference between the sun's coming to their respective meridians, or, in a word, their difference of longitude; and hence it follows, that if we, by any means, simultaneously ascertain the time at the first meridian, and the time at ship, we shall have ascertained the longitude. The easiest mode of solving this problem is by means of the chronometer. This is a watch so nicely constructed as to go with perfect uniformity, either having no error whatever, or else losing or gaining a known quantity every day. This watch is set to the time of the first meridian, and its rate is carefully ascertained before leaving the land. To find the longitude by means of it, the mariner has merely to take an observation of the sun or other star, when rising or falling rapidly, and deduce the time of ship; this, compared with the time at the first meridian, simultaneously given by the chronometer, determines the longitude. Several chronometers concurring with each other, may make the mariner sure of his position; but a single one unchecked by other data, and liable, from its nicety *of construction*, to easy derangement, is a danger-

ous guide. The many noble ships so inexcusably lost, in late years, between the entrances of the Delaware and Hudson, owe their destruction to a blind dependence on a single chronometer.

The most expeditious and certain way of observing the longitude, is by the eclipses of Jupiter's satellites. Their times of immersion and emersion at the first meridian are noted in the Almanac, and these, compared with the times at which the telescope shows the observer the occurrence of the same phenomena, determine the longitude. But the unsteadiness of a ship at sea deprives the mariner of this expeditious method. Fortunately, there yet remains open to him one sufficient accuracy: this is, by observing the distance of the moon from the sun and other fixed stars, and comparing the time of observation with that time at which the Almanac shows a similar distance for the first meridian. The only difficulty attending this beautiful method, which the rapid movement of the moon in her orbit, and her consequent change of distance from the stars, renders proportionally correct, consists, in the first place, in nicely observing the distance, and then in correcting it trigonometrically for the errors occasioned by parallax and refraction. A single *lunar observation*, like a single chronometer, has *been confided* in to the loss of many a gallant

ship: but a series of them, taken from day to day, with stars on different sides of the moon, and concurring to show the same longitude, are worthy of all confidence.

Thus, aided by these heavenly guides, is the mariner at all times able to determine his position. He should not, however, be inattentive to any means of information; he should, by observing the difference between the magnetic bearing of some heavenly body, and what calculation shows to be its true bearing, daily inform himself of that wonderful phenomenon,—the magnetic variation; he should, in calm weather, ascertain the direction and force of the current, by lowering a boat and anchoring it to an iron vessel let down below the superficial strata of the ocean; in approaching the land, he should be attentive to the changing colour and temperature of the sea, which last is, especially on our coast, an admirable monitor: also to the floating of weeds, and the flight of birds, such as do not stray far from it. All these little cares, the watching of the barometer, and profiting by its friendly predictions, and the frequent inspection of the chart, whilst they take from the *dangers* of navigation, amuse the mariner, and *beguile the tedium* of the sea.

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NAVAL WAR.

ORIGIN OF MARITIME WARS—EARLIEST INSTANCES ON RECORD—THE BATTLE OF SALAMIS—SUBSEQUENT ADVANCES OF THE ANCIENTS—THE GALLEY—NAVAL TACTICS AMONG THE ANCIENTS—CONTEST BETWEEN ROME AND CARTHAGE—VICTORY OF DUILIUS—CONDITION OF NAVAL WAR BEFORE THE INVENTION OF CANNON—GREEK FIRE—BATTLE OF LEPANTO—PROGRESS OF ART AFTER THE DISCOVERY OF AMERICA—SAILS SUBSTITUTED FOR OARS—PRESENT MODE OF SEA FIGHTS—BONHOMME RICHARD AND SERAPIS—BATTLE OF NILE—TRAFALGAR—OUR CONTEST WITH ENGLAND—ACTION OF CONSTITUTION AND GUERRIERE—WASP AND FROLIC—BATTLE OF LAKE ERIE—PRESENT CONDITION OF OUR NAVY.

IN no state of society, however primitive, has man long learned to navigate the rivers and seas that surround him, before his evil passions have involved him in contention and war. It is not enough that murder should stalk the earth, and make its fields drink the blood of him to whom *it was given* as a heritage; the ocean, already terrible in its own horrors, is aslo too often crimsoned with the same carnage.

It may, perhaps, be questioned whether maritime pursuits be not more likely to produce discord than those of the land. The shepherd subsists upon his flock; it furnishes him at once with food and raiment; the cultivator lives upon the produce of his field; but the moment that the merchant goes forth to exchange his superfluity for the superfluity of others, there arises a collision of interests; that spirit of cupidity which has, in all ages, characterised, commercial nations, is aroused; avarice, hatred, and revenge excite to discord, and the seeds of war are already sown. Thus we are told that the Phœnicians, in their solicitude to retain the vast monopoly of trade, for which they were indebted to their enterprise and industry, not only concealed studiously the courses of navigation by which they arrived at the remote countries with which they traded, but, if followed by strange vessels, would seek to mislead them, conduct them into dangerous situations, and even risk the loss of their own vessels to effect that of their pursuers. To complete the discouragement of their commercial rivals, they plundered and destroyed every foreign vessel and crew that they met with—a system which doubly favoured their desire of gain. Such is the origin of maritime war and naval armies.

The earliest instance of naval warfare recorded in history, is that of one Erythras, a prince who made himself master of the Red Sea, and monopolized its commerce, to the exclusion of the Egyptians, who were only allowed to navigate it with a single ship. The Egyptians, thus restricted, are said to have partially evaded the edict by making their single ship of an unusual size; much as the British did, in past centuries, with their single annual ship to Puerto Bello. Erythras is not, however, allowed the undisputed honour of originating naval war. He has a formidable competitor in Jason, and two still more so in Neptune and Hercules. Without attempting to settle the respective claims of these nautical worthies, we will content ourselves with endeavouring to discover the nature of naval war in the earliest ages of history.

The most noted battle of ancient times is that which took place between the Greeks and Persians at Salamis, five centuries before the Christian era. The situation of the Grecians struggling to preserve their liberty from the threatened yoke of Xerxes; the generous rivalry of Aristides and Themistocles; the heroism of Artemisia, with many romantic incidents, combine to shed a strong interest over this famous engagement. The Grecian

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from the various nations of the allies, and from a plurality of commanders, threw them into utter confusion. Moreover, among the Persians and their allies there was much disaffection; while, on the contrary, the Greeks had a good cause, and every thing at stake; their vessels, too, were light and manageable, and they were expert in manœuvring them; they did every thing in good order; finally, they had but one supreme commander, and he Themistocles. Under such circumstances, it is not much to be wondered at that they should have proved victorious.

There are one or two incidents, which took place during the battle, not a little characteristic of the mode of fighting and of the manners of the times. We are told of a Grecian galley being sunk by an Ionian of the Persian fleet; this, in turn, sustained a like fate, being run down by a galley of Egina. But, before their vessel sunk under them, the Ionians had time to throw themselves into the ship of their antagonists, and by the desperate bravery to which they were urged by their situation, seconded by their dexterity in the use of the spear, for which they were famous, gained possession of the Eginetic galley. Still more peculiar was the stratagem by which the queen Artemisia contrived to escape. She had opposed the engagement; but when it was

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coasts of Europe and Africa, and even to the British isles. So extended a commerce, and the spirit of monopoly with which it was carried on, led to the creation of powerful armaments; which were also necessary for the protection of the many colonies which Carthage possessed in Spain, Sicily, and elsewhere.

The galley was the form of ship used in war by the Carthaginians. Their *triremes*, as they were called by the Romans, from their having three rows of oars, were usually one hundred feet in length, ten in breadth, and seven in height. This form, long, low, and narrow, though not adapted to encounter a stormy sea, was admirably suited to move rapidly in smooth water; for, whilst the small breadth opposed little resistance in dividing the water, the extreme length made room for many rowers, and gave great impetus to the attacks of the beak. The bow curved upwards, forming a circular beak, which was faced with iron; or else it receded suddenly, having a single sharp point, like a ploughshare, projecting at the surface of the water, and intended to open the side of an antagonist, and cause her destruction. Frequently the beak was formed to represent a lion, tiger, or other ravenous *beast calculated* to inspire terror. It was always *surmounted by* the national emblem; thus an owl

stood on the prow of an Athenian galley; a cock on a Phœnician or Carthaginian; and the eagle on a Roman. Here or at the stern were also placed the ensigns and standards, and trumpeters, standing beside them, sounded their shrill blasts to inspire courage at the moment of onset. From the bow to the stern there extended a flooring or deck, which served as a battle-field for the mailed and heavy-armed soldiers who fought. The stern was covered with a circular shed or pavilion, richly carved and decorated with streamers and trophies. Under this was placed the *tutela,* representing some patron deity, to which sacrifices and prayers were offered, and which was held so sacred as to furnish a sanctuary to whoever took refuge there. From this elevated station, too, the commander surveyed the fight and directed the efforts of his followers. There were two distinct classes of officers and men in each galley. The commander of the soldiers was supreme, and under him the pilot, who took his station abaft, at the side of the steersman, directed all necessary evolutions and manœuvres. The pilot was assisted in the command of the sailors by his mate, and by the *agitator* or encourager of the rowers, whilst a musician marked the measure of the stroke, and, by the harmony of his voice and instrument, inspirited the rowers when weary with toil. As for the rowers themselves, they were

placed below deck on rows of benches, ascending above each other diagonally, the bench of one serving for the footstool of his comrade immediately above and behind him. We read of five benched, eight benched, and even forty benched galleys; but this cannot possibly mean, as many suppose, so many distinct banks of rowers. L'Escallier very reasonably suggests that this enumeration must have applied to the various divisions of rowers, similar to that of the batteries of modern ships; for, in an American first rate, we have ten or more divisions of cannon; and a ten decked ship is no greater absurdity than a galley with ten ranks of rowers. In proof of this, the medals, which in all cases copy the noblest forms, show us no galley of more than three rows; and even in this case, the upper tier must have been very unwieldy, for the length of the oar necessarily increased with each ascending bench. Hence it was not only necessary to place the stoutest and most athletic rowers at the upper oars, but likewise to load the handles of them with lead, in order to counterbalance the great weight without. We have already said that these rowers were distinct from the soldiers who fought, for rowing was esteemed a great drudgery, and was not unfrequently, in ancient as in modern times, the punishment of malefactors, who were chained perpetually to the benches on which they rowed. It

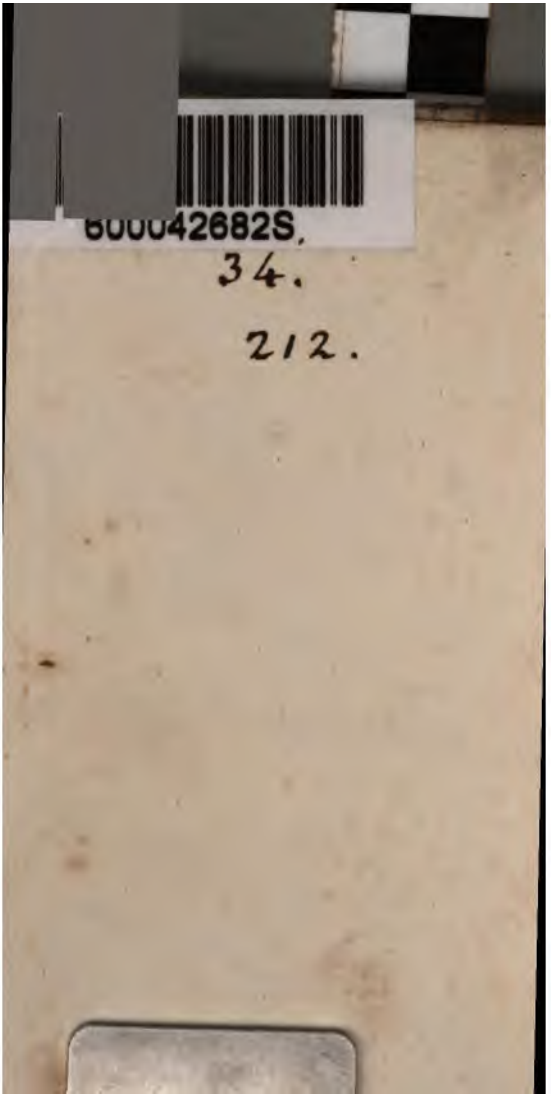
was, perhaps, from the infusion of such unamiable materials, that sailors came to be esteemed infamous and wicked wretches, totally destitute of humanity and religion. Galleys were steered with oars run out on the quarters, and managed by men standing near the pilots, and ready to obey their orders. Sails were also used to ease the rowers, and attain a greater velocity, when the wind was fair; both masts and yards were, however, generally taken down and stowed out of the way, on the eve of an engagement, and the oars alone used, thus enabling the galley to move and turn without reference to the direction of the wind. These sails were sometimes made of variegated stripes, and we occasionally read of the galley of an emperor or an admiral having sails of purple, embroidered with gold. The body of the vessel was tastefully painted, representing gods, animals, or historic scenes, and sometimes the oar blades were richly gilded.

Such were the locomotive means of the galley. Its means of offence consisted in the various weapons and missiles used on land. Javelins and arrows were discharged in showers from the deck, or from turrets at the bow and stern. As a protection from these, a curtain of hides was used, *from behind* which the soldiers discharged their *missiles in* return, or thrust with very long spears,

used only at sea. In the centre were engines from which rocks were projected of sufficient size to sink a ship; and, as the combatants approached, great masses of iron, from their form called dolphins, were let down from the elevation of the mast-head, and sometimes passed through the bottom of an adversary to his inevitable destruction. Battering rams, which were beams pointed with iron, were also suspended from the mast, and forced with destructive effect against the enemy's side. But the great means of annoyance was the attack of the beak; and, in order to make it with complete effect, it was very desirable to gain the wind, so as to bear down upon an adversary with the greatest velocity, demolish his oars, open his side, or even overturn and run down the vessel. Earthen pots of live coals and pitch, and of combustibles ready to combine and burst forth in flames, were either cast from ship to ship, or so suspended over the beak, that when the shock took place they would fall on the deck of the assailed. It is said of Hannibal, an ancestor of the great Hannibal, that he threw, on one occasion, pots containing live snakes upon the enemy's deck, and, as he had conjectured, filled the crew with horror at so unwonted an attack, and availed himself of their consternation in securing the victory. *Fire ships* were also used at this early period *with destructive* effect. The line of battle was

usually triangular, the admiral's ship being at the angle in advance, and the line of store-ships forming the base. Before engaging, it was usual for the admiral to pass in a small boat throughout his fleet, haranguing his followers, and urging them to do their duty. Thus inspirited, a shout of anticipated triumph would pass from ship to ship; and when the gilded shield was at length displayed as a signal for battle, the shrill trumpets sent forth their blasts, and the combatants rushed to the encounter, rending the air with shouts and war songs. The battle won, the victors returned to port, towing their prizes, their ships being decorated with fragments of the wrecks, themselves crowned with laurel, and singing pæans to Apollo. The richest of the spoil was reserved as an oblation to the gods, and broken, or even entire galleys were placed in the precincts of the temples.

Such was the state of naval warfare, until the Romans, incited by their contest with Carthage for the possession of Sicily, first turned their attention to naval affairs. Such was the invincible daring of this nation, that, having scarce ever dreamed of navigation, they yet resolved to attack the Carthaginians on their own element. At this conjuncture, *a Carthaginian* cruiser, accidentally stranded on *their shores,* furnished them with a model. But



the famous galley of Hannibal, the Carthaginian admiral, which had once belonged to Pyrrhus. The admiral himself narrowly escaped in a small boat. This victory, if we consider the circumstances under which the battle was fought, is inferior to none in history. It was duly estimated at Rome the most extraordinary honours were decreed to Duilius, he being the first Roman who enjoyed a naval triumph. A rostral column was also erected to him, upon which were placed the beaks of the Carthaginian galleys. This *columna rostrata* is still seen and admired in old Rome, where the stranger does not fail to visit it, and where, turning from the humiliating picture of modern degeneracy, he traces with pleasure an inscription which recalls the best days of the republic.

From this time until the invention of cannon naval warfare underwent little variation. The emperors of Constantinople continued to observe the same system of annoyance and defence in their navy, which must have been considerable, as we read of an expedition sent to subdue Crete, consisting of 200 ships and 49,000 men. They had reduced the height of their galleys, using now but dromones of two tiers, having in all 100 oars rowed by as many men. A level platform covered the rowers, upon which the soldiers drew up in

fought as upon land. The captain stood at the poop between the two steersmen, whence he directed the efforts of his followers. Thence, too, he discovered and obeyed the signals of his admiral—an invention already introduced to signify orders at a distance. The line of battle was somewhat changed; from a triangle it had become a crescent. The horns pointed rearward and the admirals stationed in the centre began the attack. The same means of annoyance were still employed; arrows were shot from bows and cross-bows; javelins were discharged from engines; and huge rocks were projected from machines, which, we are told, often found their way through the deck and bottom of the hostile vessel, destroying both galley and crew. But the most dreadful weapon then in use was the iron tube, from which the Greek fire was projected in streams upon the vessel and crew of an enemy. This combustible, which had been much earlier used, in the less destructive form of missiles, was of such fearful activity that nothing could resist it, and water, instead of extinguishing, did but augment its fury. Terrible must it have been to the northern pirates, of whom we are told that, imitating those of their countrymen who invaded Europe by other routes, they descended in canoes, by the *Borysthenes, into* the Black sea. Having plundered its shores, they were hastening to seize upon

Constantinople, when they were met by the fleet of the emperor. Hardly had they raised their war-shout, as they paddled their canoes to the assault, when they were met by well-directed streams of liquid fire, issuing from the prow of every Grecian galley. Consternation seized them, and they plunged into the sea, happy in having yet the alternative of a choice of deaths.* Though the attack of beaks was still continued, less importance was now attached to the point of gaining the wind. In order to escape from the torture of the fire tube, it was more usual at once to grapple broadside to broadside, and, while the rowers assailed each other with pikes through their row-ports, the soldiers rushed, with sword and buckler, to the attack, fighting desperately, hand to hand. Hence it is that, in the history of those times, we so frequently read of ten, twenty, and even thirty thousand men, slain in a single naval encounter.

* The Greek fire has lately been reinvented by an American of the name of Brown. He discharges it, like any other fluid, from a common engine, and, from its resinous and cohesive nature, projects it much further. As it passes out of the tube into the open air, a match, placed at the end, converts it into liquid fire, of a destructive energy, not at all inferior to what is attributed to that of the Greeks. He has *offered his* invention to our Government; and, as connected *with a system* of steam-batteries for the defence of our coast, *it would prove* terribly efficacious.

At length, a great revolution in naval warfare was brought about by the introduction of cannon. They were first used by the Venetians against the Genoese, in 1370. It is a little singular, when we consider their efficacy for the destruction of ships, that they should not have been employed for this purpose until a whole century from their first use in Europe by the Saracens, in the defence of Niebla, and nearly thirty years from their general introduction, as an implement of war on land, at the siege of Algeziras. When first introduced, the cannon were mounted on the deck which covered the rowers, and were either made to protrude over the rail, or else were pointed through port-holes pierced through the bulwark which defended the crew. In the *galleas*, which was first used at Lepanto, there was one row of ports between the oars, and then batteries of heavier cannon upon the poop and forecastle. Notwithstanding all these innovations, we shall yet find that the ancient mode of naval warfare was, in a great measure, maintained in that renowned naval battle, the battle of Lepanto.

The battle of Lepanto was fought between the Papal, Venetian, and Spanish fleets, and that of Selim, Sultan of Constantinople. In September, 1571, the Christian fleet was collected, and made ready, in the port of Messina. It consisted of 250 ships

manned by 50,000 men, and was placed under the command of Don John of Austria, natural son of Charles V., for whom expressly the title of generalissimo was then invented. The pope, having proclaimed a general season of fasting and prayer throughout Christendom, sent a strong corps of ecclesiastics to officiate in the fleet, and a consecrated standard to be displayed from the ship of the admiral. Absolution was promised to every sinner who should fight for the faith, and heaven was opened to the slain. Don John was urged to give immediate battle, and to feel secure of victory. Selim, on the other hand, was not backward in preparing to meet the danger. Though part of his forces was still employed in reducing the island of Cyprus, which was the original subject of contention, he yet succeeded in equipping a fleet still larger than that of the Christians. It was entrusted to the Pacha Ali, who proved himself well worthy of the charge. Nor was the Sultan slow, on his side, in promising all sorts of good things, to the defenders of the faith, and in picturing the joys of a Mohammedan paradise, as the prize of martyrdom. Both parties were to fight the battle of the Most High. The two fleets came together in the *gulf of Lepanto*. What the Christians wanted in *numbers, they* made up in superiority of equipment. *The prows of* their galleys, were closer, and better

defended, and their soldiers better provided with offensive and defensive armour. They made general use of helmets, coats of mail, and fire-arms, whilst many of the Turks defended their bodies with large leathern shields, and had no more destructive missiles than arrows. Moreover, fortune turned against them at the moment of onset; for the wind, which had hitherto been favourable to them, now blew in the sails of the Christians. The battle, as of old, began with the admirals. Don Juan and Ali, after a short cannonade, closed and grappled. Both crews rushed to the assault, meeting, in deadly struggle, upon the gunwales. Three times did the Spaniards gain the deck of their adversary, and as often were they driven back. Perhaps the Turks would have followed up their advantage to complete victory, had not Don Juan, in that critical moment, received a timely reinforcement of 200 men. By their assistance, the Turk was again boarded, and no longer with doubtful success. The slaughter was indiscriminate and terrible, the crescent being quickly lowered, and replaced by the cross, whilst the severed head of Ali, planted on a pole, and hoisted at his own masthead, filled the breasts of his followers with momentary consternation. Scarce was this result manifest, ere the cry of Victoria! *Victoria!* pealed from the ships of the *Christians;* and, led on by a host of heroes—a Co-

lonna, a Veniero, a Doria—they rushed furiously upon the enemy. Nor did the Turks tamely yield the victory, which they had, of late, so often won. The ships grappled: the enemies fought hand to hand, and sword to scimetar; pikes, javelins, and arrows, cannons, matchlocks, and arquebusses, aided the fury of the combatants. Turks and Christians had never fought so valiantly, though that was emphatically the age of daring. At length, whilst the result was yet doubtful, the Turkish galley-slaves, taking courage at the partial success of their fellow-Christians, and dreading the effect of the reverse upon their own condition, suddenly rose, broke their chains, attacking their masters with them, or with whatever other weapons fury furnished them, and repaid them, in a few short moments, for years of cruelty. In an opposite manner, the criminals who performed the same office at the oar in the Spanish and Italian galleys, having asked leave of their officers, and been unchained and armed, boarded the enemy with a fury rendered irresistible by despair, a recklessness which had nothing to lose, and the double hope of meriting liberty or obtaining martyrdom. At length, the few Turks that remained began to think of flight. Thirty galleys alone escaped to Constantinople *through the skill* of the intrepid corsair Uluceiali, *who carried* away the standard of Malta, as a tro-

phy.* A few reached the neighbouring shore, and abandoned their ships; 130 were taken; the rest were either sunk, burnt, or battered to pieces: 10,000 Turks were taken, 25,000 slain; 15,000 Christians were released from the servitude of the oar. Nor was the victory cheaply purchased—10,000 Christians were among the number of the victims. Beautiful had been the display of the encountering fleets, but now how changed the spectacle! Shattered fragments of wrecks and masts covered the sea, which was every where streaked with human blood, or strewed with limbs and disfigured corpses. The whole of Europe resounded with shouts for this glorious victory, and with the praises of its hero. He was pronounced the greatest warrior of the age; the Christians of Mace-

* The corsair carried away a more precious treasure in the person of the poet-hero Cervantes. His intrepidity had hurried him among the first on board of the enemy's galley, to which his own was grappled; but his comrades were repulsed, the grapnels broken, and he, left wounded on the deck, was carried away by the renegado, as he himself tells us in the beautiful episode of El Captivo, "the only captive among so many liberated, the only sad one among so many rejoicing Christians." The matter might, however, have been worse. Had Cervantes been slain, instead of taken at *Lepanto, we had* never known the valiant Don Quixote, nor *the facetious* Sancho.

donia and Albania tendered him the sovereignty of their country; and, as for the pope, when the news reached him, he is said to have exclaimed, in a holy ecstasy, "There was a man sent of God, whose name was John."

The rapid improvements which the discovery of America effected in naval architecture, for commercial purposes, extended equally to its other branches. A gradual improvement took place in the form and adaptation of ships of war, and they were, at the same time, progressively increased in force and size, until, before the close of the sixteenth century, we already read of Spanish and Portuguese ships of eighty and ninety guns. In the last century ships of war at length attained a size which may be considered as a maximum; for nature herself has set bounds, to surpass which would be, if not impossible, at least inconvenient. Many harbours exclude vessels of excessive depth; the trees of which ships are made do not exceed a certain growth; and man, who is to construct, equip, and finally manœuvre these wondrous machines upon the deep, though able to effect much by an advantageous application of his strength, and by concerted efforts, is yet a being of limited powers. The English *Caledonia*, the French *Commerce de Marseilles*, and the Santissima Trinidad,

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volution in the manner of propelling
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mode of naval warfare. This we shall now exemplify, by briefly describing the present mode of engagement, and relating a few instances of modern naval battles between single ships and fleets.

When two adverse ships come in sight of each other upon the ocean, accident decides, usually, which is to windward. To be to windward, or to the side from which the wind comes, is always esteemed an advantage. If the weather ship be of inferior force, it enables her to keep out of action much longer, and, though a poor sailer, she may do so until the intervention of night increases the chances of escape. If, however, the weather ship be of superior force, she is enabled to bear at once down, and direct her head upon the enemy, and, having the advantage in sailing, must soon be alongside of her. We will, however, suppose a case in which two equal ships meet, and are mutually anxious to engage. Then, also, the weather-gage is an advantage, for the ship to leeward, careening to the breeze, exposes her side below wind and water, and, if struck there, and afterwards forced to tack and change her careen, or if merely brought upright, the shot-holes thus made are thrown out of the reach of repairs from without, and may cause her sinking. The ship to windward, on the contrary, has her lee side exposed to

the attack, and the ordinary water-line depressed below the surface, in proportion to the strength of the breeze. In this situation, if she receives dangerous shot-holes at the water's edge, by changing her tack, she may bring them above the surface, so as to stop the leaks. Being to the windward ,moreover, confers the advantage of bearing up at pleasure to cross an enemy's bow, or stern, for the purpose of a raking fire.

Assuming the advantage of the weather-gage, let us prepare for action. Topsails, top-gallant-sails, jib and spanker, with the courses hauled up, ready to be set again, are good sails to fight under, for with them your ship is under perfect command to advance, manœuvre, or lie to. If there is an appearance of squally weather, it is well to have a reef in the topsails, in anticipation. The crew are called to quarters by beat of drum, every man going to the station which has been rendered familiar to him by frequent training, under the eye of his officers. The commander, standing in a conspicuous station on the quarter-deck, watches his own ship and the enemy, and conveys the order that the occasion may require by voice, or through the medium of his aids. Under him, the first lieutenant commands the offensive and defensive operations, and effects the various evolutions which he may

direct, in relation to the position of the ship. The clues are stoppered, to keep the sails spread in the event of the sheets being shot away, and the yards are hung in chains, to obviate a like inconvenience from the cutting of the ties. The carpenter rigs the pumps to prepare for a leak, collects the shot-plugs to stop holes in the side, and fishes of wood to strengthen a mast, or yard, that may be wounded, and in danger of falling. The surgeon prepares, in the cockpit, to relieve the wounded. Tubs of water are collected on the tops, channels, and on deck, to be ready to extinguish fire; the decks are wet to prevent the explosion of powder, and put out sparks that may fall there, and also sanded to prevent the men from slipping when splashy with blood or water. Finally, plenty of wads and shot, round, grape, and canister, are collected beside the guns, and the magazine is opened and lit by the gunner and his crew, who prepare to pass the cartridges to the powder-boys.

And now, having given three cheers, you bear down upon the enemy. It is a great object, in battering from ship to ship, to rake your enemy, if possible; that is, to get across his bow, or stern, out of reach of his guns, whilst yours sweep the *whole length* of his deck, with fatal execution. If *it is desirable* to rake your enemy, it is equally so to

avoid being raked in return. This double advantage can only be attained by superior sailing, or by great skill in manœuvring. In directing your fire, it is best to aim between wind and water, and also in the direction of the masts, for in this way the enemy may be soonest disabled, and a victory gained with the least destruction of life. If, on the contrary, your own spars be so disabled that the enemy, having the worst in other respects, might yet effect his escape, from your inability to make sail in pursuit; or even in the more desperate case of your being every way worsted, you may yet profit of your situation to bear down and board, as the last alternative. In the case of this last chance, a hopeless cause may sometimes be restored; for, in boarding, headlong valour, oftener than numbers, decides the struggle. When the enemy signifies that he yields, by hauling down his colours, a prize-master and crew are detailed; the prisoners are removed and chained, and as much exertion is made in repairing damages as was before exercised in effecting them.

Of all the naval battles, in ancient and modern times, none has ever been more obstinately contested than that which took place during our revolution, between the Bon Homme Richard, as she *was called* (after Doctor Franklin's Poor Richard,)

and the British frigate Serapis. The first was
manded by Commodore Paul Jones, the l
Commodore Pearson, a very distinguished
The Richard carried fifty-six guns, and 380
the Serapis fifty-nine guns, and 320 men.
former was old and decayed, with a motley b
throwing only 282 pounds at the single broa
and twenty of her best men with, the secon
tenant, were absent during the whole action.
Serapis, on the contrary, was a new ship,
proved construction, considered the fastest
in the British navy; and, besides her superio
number of guns, they were of heavy calibre,
ing 340 pounds at a single broadside.
having borne down to cut off the Baltic flee
the harbour of Scarborough, the Serapis a
consort stood out to divert the attention
American ships, and give the convoy time to
In this way the battle began. One of Jones'
sorts engaged the consort of the Serapis; th
took no part in the action till towards its
when it fired, with equal injury, upon both
guns were fired from either ship until the
proached within pistol shot, when Pearson
out, "What ship is that?" This was at ei
the evening. The sky was beautifully clea
the sea smooth oon, just then risi
the combatant bled crowds of

collected on Flamborough Head, to watch the progress of the battle. When Commodore Pearson had waited in vain for an answer to his challenge, the Serapis opened a terrible fire upon the Richard. It was at once returned; but three of the Richard's heaviest guns burst at the discharge, not only becoming lost for the rest of the fight, but destroying more men than the whole broadside of the Serapis, and scattering death and confusion on every side. The battle had not continued long, ere Jones found that he was suffering so much from the Serapis being able, by her superior sailing, to choose raking positions, that he would soon have to yield, if the contest continued so unequal; he therefore ordered his ship to be laid on board the Serapis. This manœuvre did not succeed, for the Richard could not bring a single gun to bear. Jones therefore backed his sails and sheered off, when Pearson, thinking the American was about to yield, because his fire had ceased, asked him if he struck; to which Jones answered, that he had not yet begun to fight. He was not long, however, in making a commencement; for, having sailed by the Serapis, he once more put his helm up, and ran across her bow. Her jib-boom came over the Richard's poop, and Jones himself assisted the master in making the jib-stay, which had been shot away, *and hung down* upon his deck, fast to his mizzen-

mast. At the same time, the anchor of the Serapis hooked one of the Richard's ports, so that when presently Pearson anchored, to let his enemy sweep clear of him with the tide, both ships swung beside each other, the stern of the Richard to the bow of the Serapis, and their starboard sides so close together that the guns met, muzzle to muzzle; the rammers entered opposite ports, and were dragged from those who used them, who presently began assaulting each other. It is a singular proof of the coolness of Jones that, while engaged with the master in making the vessels fast, he should have thought to check him for his profanity, saying; "Mr. Stacy, this is no time for swearing, in the next moment you may be in eternity. Let us do our duty." Thus grappled, the two ships kept up a long and desperate struggle for victory. In battering, the superior metal of the Serapis gave her a decided advantage; her shot went through and through the rotten sides of the Richard, cutting the men in pieces, and destroying them with splinters. The rudder was destroyed; the quarter beat in; and while the water entered on every side, one of the pumps was shot away. There was already four feet of water in the hold, and it gaining. Upon this, the carpenter, instead of concealing the ship's situation from all *but the captain,* cried out that she was sinking. *The panic spread.* The master-at-arms, moved

by the supplications of a hundred English prisoners confined below, released them from irons; and the gunner ran terrified on deck, and bawling for quarters. Among the prisoners thus left at large, one of them, a ship-master, crawled through the ports to the Serapis, and told Captain Pearson to hold out, for he had begun to meditate a surrender. Nevertheless, Jones quickly recovered from his desperate position. He punished the cowardice of the gunner by throwing his pistols at him, one of which fractured his skull, and precipitated him down the hatchway. At the same time, he repulsed an attempt to board from the Serapis, and removed the danger of so many prisoners at large below by employing them at the pumps, and telling them to work or sink.

Whilst the battle had taken this unfavourable turn below, the face of affairs was reversed above, by the exertions of a few men stationed in the tops of the Richard. According to Jones's orders, they had first directed their fire into the enemy's tops, until not a man remained alive, except one in the fore-top, who kept loading his musket, and dodging, now and then, from behind the mast, to fire. This bold fellow was at length struck by a ball from the Richard's main-top, and sent headlong upon deck. And now the exertions of the sharpshooters were all turned to clearing the decks of

the Serapis. Some of the bravest even passed, by the yards, into the tops of the Serapis, whence they threw port-fires, flasks, and grenades down her hatches, stifling her men, and firing the ship in various directions. At this time, both ships having taken fire, the cannonade was suspended, to extinguish it. Jones soon renewed it, however, from some guns which alone remained in order on the forecastle, and which he directed himself. At the same time, a grenade, thrown from the Serapis's top, having bounded into the lower deck, and fired some loose powder, this communicated to the cartridges, which had been brought from the magazine faster than they were used, and laid carelessly upon the deck; and a general explosion took place, by which every man in the neighbourhood was blown to pieces, or dreadfully burned. No way remained for Commodore Pearson to save the remnant of his crew, but to yield: but even this it was not easy to signify, for none of his crew would venture to take down the flag, which had been nailed, before the action, to its staff; and he was compelled to perform the perilous and humiliating task with his own hand. Thus ended the battle of the Bon Homme Richard and Serapis. The victory was dearly bought, for the carnage on both sides was *terrible.* The Bon Homme Richard lost three *hundred men,* in killed and wounded; and nearly

all the last died, from the indifferent care which they received, and the dreadful gale which followed the battle. The loss of the Serapis was nearly as great. Of the men who were blown up, some lingered until the flesh dropped from their bones, dying in excruciating agony. The Poor Richard, assailed by fire and water, was abandoned to her fate, and went down, carrying with her many of her wounded crew.

The battle of the Nile is a brilliant specimen of fleet engagements. Nelson, after having long pursued the French fleet which bore Napoleon and his fortunes, at length came in sight of them on the 1st July, 1798. They were moored in the Bay of Aboukir, in a solid line of battle, forming a small curve along the shore. The forces on both sides were nearly equal, there being on either side thirteen ships of the line; the French having, if any thing, the advantage in the superior size of their ships.

The moment that Nelson beheld the formidable array, and admirable disposition of the French fleet, his intuitive genius immediately seized the idea of overpowering a portion of them at first, by directing the whole efforts of his force upon it, giving orders *to anchor one of his ships within, and another without such ships* of his adversary as came first. He

At nine the Orient was discovered to be on fire, and the flames spread with awful rapidity. Many of the crew were seen in the conflagration to plunge into the sea, endeavouring to save themselves upon the fragments of spars that were scattered on every side; others struggled to reach the shore or the British ships, but by far the greater number are said to have continued fighting at their guns to the last. A brilliant example had been shown them in the heroic Bruey, their Admiral, who refused to leave the deck after he had received three dangerous wounds, and when at length a round shot, striking his body, nearly severed it in two, he still gave orders that he should not be removed, but be allowed to die upon his quarter deck. At length the ship was involved in one vast blaze that showed the whole of the contending fleets, and revealed the full horrors of the scene to thousands of Egyptians who lined the shore, and covered the house-tops. Soon after, the fire reached the magazine, she then blew up with a tremendous crash, sending her spars, and part of her hull, far into the air. The burning fragments and cinders, falling on every side, created apprehensions that the conflagration would become general, and the desperately grappled enemies be involved in one *common* ruin.

The shock of this explosion was so terrible that for a moment the cannonade was suspended, and the combatants paused as if horrified by the effects of their own fury—or perhaps alarmed by the danger it had brought upon themselves. It was however soon renewed along the remainder of the line, and continued until three in the morning.

We are told that Nelson, being wounded and under the hand of the surgeon in the cockpit of the Vanguard, had found his way on deck in the confusion which the report of the Orient's being on fire had occasioned. He observed a number of the French sailors throwing themselves into the sea to escape from their burning ship, and, with characteristic humanity, ordered his boats to be lowered and despatched to their succour, yet he was himself suffering the most acute anguish from the wound which he had received in his forehead, and nearly blinded by the blood which streamed from it. Another beautiful trait which he exhibited on this occasion, was when he was first wounded and carried below; the surgeon, sensible of the superior importance of his new patient, abandoned a sailor whose wound he was dressing, and hastened to the Admiral. "No," said Nelson, "I will take my turn like another man." And he actually refused

all services from the surgeon, until those who had come before him had been first attended to.

Only four of the French ships, from the extremity of the line, which had been but partially engaged, contrived to cut their cables and escape; and the British ships were too much crippled to pursue them. The result of this victory, therefore, was most decisive and brilliant. Nelson even said, that victory was not a sufficient name for it.

The battle of Trafalgar, which took place not many years after, was fought near Cadiz, between the allied French and Spanish fleets, of thirty-three sail of the line, and the British fleet of twenty-seven sail. The force of the allies was far superior in ships, guns, and men, and they had a brave and skilful commander in Admiral Villeneuve; but there were circumstances that more than counterbalanced the disparity. The Spaniards had no national interest in the struggle, and between them and the French there was no cordiality. The allied ships, too, had been hastily refitted, and, having just put to sea, were very inefficient; for their crews, belonging as they did to nations which had little commercial marine, and *few seamen*, were made up, in a great measure, of

soldiers, who had never been long enough embarked to get their sea legs. The British ships, on the contrary, were in the finest order; their crews had been actively employed during years of war; they were commanded by veteran officers each a hero of many battles, all obeying one only admiral—Nelson of the Nile.

Having taken his station off Cadiz, Nelson waited the sailing of the enemy, who were ignorant of his force, and had determined to put to sea. On the 19th of October, 1805, the frigates on shore repeated the signal that the enemy were coming out; on the 20th, they were all at sea off Cadiz; and on the 21st, after much manœuvring, the two fleets came in sight, with a mutual determination to fight. This day had been a festival in the family of Nelson, because it was the anniversary of a victory gained by his uncle. To Nelson, whose peculiar mind was no stranger to superstition, the omen was most welcome. Yet, though he expected to win the battle, he felt equally sure that he would not survive to enjoy it. He had heard that the enemy's fleet were filled with Tyrolese sharp shooters, stationed in the tops, and knew of course, that his own life would be especially aimed at. Far from dreading such a result, it seemed to be the dearest wish of his heart to die on his quarter deck in the

moment of assured victory. Perhaps the perplexed condition of his domestic relations may have rendered him at times dissatisfied with himself and willing to part with life; perhaps he reflected that to die in battle was alone necessary to make the name of Nelson deathless. He therefore, in despite of the entreaties of his friends, insisted upon wearing his uniform of Admiral; the frock coat covered with stars and decorations, each the reward of some brilliant deed in the cause of his country. Even when persuaded by Hardy to order other ships to pass ahead, he still carried all sail on the Victory, thereby rendering it impossible for the order to be obeyed.—The allied fleet formed their line of battle on the larboard tack, the wind being at south-west. Trafalgar lay to leeward, and the bay of Cadiz was open for escape. The ships were drawn up in a double line in close order, the intervals in the first line being filled by the ships of the second, with room to fire between. This combined the advantage of a dense, unassailable column, with a sufficient interval to obviate the danger of contact among the ships. Nelson bore down also in a double line, himself leading the left of fourteen ships in the Victory, and Collingwood, *in the* Royal Sovereign, the right line of thirteen *ships. His* object was to break the line of the *enemy in two* points, separating and overpowering

them in sections inferior to his own. Above all, he directed his captains to remember that his object was a close and decisive action; and that if his signals were not seen, no captain could go wrong in placing himself quickly and closely alongside an enemy. The wind was light, and the British fleet, under a crowd of sail, bore gallantly before it, rising and falling gracefully upon the long swell that rolled towards the bay of Cadiz. Nor was the array of the allies less noble and imposing, as they firmly awaited the approach of their enemies, drawn up in their double line, and with the sun shining full upon their white sails and frowning broadsides. The scene—the purpose—were full of sublimity; and to Nelson, who, independent of his thirst of glory, fancied that in destroying Frenchmen he was about to serve humanity, this moment must have been the proudest of his life. As he gazed upon his anticipated prize, he asked Captain Blackwood what he would esteem a victory. The answer was, that, considering the noble manner in which battle was offered, the capture of fourteen sail would be a brilliant result. "I shall not," said he, "be satisfied with less than twenty." Presently Blackwood took leave, to return to his own ship, and expressed the hope soon to congratulate the admiral upon the accomplishment of his wish. Nelson pressed his hand affectionately, and said,

"God bless you, Blackwood! I shall never see you again." And now, from the mast-head of the Victory was unfurled that eloquent signal—"England expects every man to do his duty!" In consequence of the second column being steered more off the wind, at a less acute angle with the enemy's line, Collingwood came much sooner into contact with it; broke through it astern of the Santa Anna, firing raking broadsides on either hand as he passed, and engaging the Spaniard to leeward at the muzzles of his guns. At the same time, three or four other ships gathered round, pouring their broadsides into the Royal Sovereign. "See," cried Nelson, "how that noble fellow, Collingwood, carries his ship into action!" And Collingwood, on his side, appreciating the feelings of his chief, was just then saying to his captain, notwithstanding the uproar and carnage, "Rotherham, what would Nelson give to be here!" Meantime Nelson was bearing down, exposed to a raking fire from all the ships under his lee, without being able to return a broadside. His secretary was killed beside him; directly after, a double-headed shot struck a party of marines drawn up upon the poop, near him, killing eight of them; and in another minute, a shot passed between the admiral and *Captain Hardy*. Each for an instant believed the *other killed*. At length the Victory, having run

between two of the enemy's ships, opened both her broadsides with tremendous effect. Soon after, the Victory ran on board the Redoubtable; which ship was closely engaged by the British Temeraire; and, another enemy having fallen on board of the Temeraire, the whole four lay desperately grappled, broadside to broadside. Whilst to the left the Victory received and answered the fire of the Bucentaure and Santissima Trinidad, on the right she depressed her guns so as not to send the shot through into the Temeraire. The Redoubtable let down her lower deck ports, for fear of being boarded through them, but kept up a fire from the upper batteries and from small-armed men stationed in the tops. From a generous, though mistaken and Quixotic sense of humanity, Nelson made no use of small arms in the tops, either to clear the enemy's decks and pick off officers, or to silence the fire of their topmen. To this fault he owed his death; for after he had twice ordered the fire upon the Redoubtable to cease, because she seemed to have struck, a ball fired from her mizzen-top, which was quite close to the poop of the Victory, struck his epaulette, and entered his back. He fell with his face upon the deck. Hardy turned round as some men were *raising him*:—"They have done for me at last, *Hardy*," said he. As they carried him down the

ladder, he remarked that the tiller ropes had been shot away, and ordered them to be replaced. Then with his handkerchief he covered his features and decorations, desirous now to conceal from his crew, lest they should be disheartened, what he had been unwilling to hide from the enemy. Soon after he reached the cockpit, his wound was discovered to be mortal; he felt it himself, and insisted that the surgeon should leave him, to attend those whom he might yet save. He was in great pain, and intensely anxious to know how the battle went. "Will no one bring Hardy to me?" he asked. "He must be killed! He is surely dead!" At length Hardy came, and the two friends shook hands in silence. After a pause, the dying man faintly uttered, "Well, Hardy, how goes the day?"—"Very well; ten ships have already struck." Finding that all was well, and that no British ship had yielded, he turned to speak of himself. "I am a dead man, Hardy! I am going fast! It will soon be all over with me!" Hardy hoped that there was yet a chance of recovery. He said, "O, no! it is impossible. I feel something rising in my breast that tells me so." The surgeon asked him if he suffered much. He answered, so much that he wished himself dead. "And yet," he added, thinking perhaps of the new honours that awaited him, "one would like to

live a little longer." Captain Hardy, having been again on deck, returned, at the end of an hour, to his dying friend. He could not tell, in the confusion, the exact number of the allies that had surrendered; but there were at least fifteen; for the other ships followed their admirals into action, breaking the enemy's line, and engaging closely to leeward, in the same gallant style as the Victory and Sovereign. Nelson answered, "That is well; but I bargained for twenty." And his wish was prophetic; he had not miscalculated the superiority of his followers; twenty actually surrendered. Having ordered the fleet to be anchored, he again spoke of himself.—"Don't throw me overboard. Kiss me, Hardy." Hardy knelt down and obeyed in silence. "Now I am satisfied. Thank God, I have done my duty." Hardy kissed him again received his blessing, and then took leave of him for ever.

Since the battle of Trafalgar, naval war has undergone but slight modification. The English, contented with beating the French wherever they met, took little pains to increase that superiority which was already so decided. With us, however, the case was different; and when, in the year 1812, we were forced, weak and unprepared as we *were, into* a war with Great Britain, it became necessary for us to put forth efforts proportioned to

the formidableness of our foe. Happily these efforts were not unattended with success. Though our ships were met on all sides with an array of numbers which compelled them to disperse, and haunt the ocean singly, depending upon their superior sailing for escape, yet when they occasionally found themselves broadside and broadside with an enemy of equal and even slightly superior force, they were, with a single exception, invariably triumphant. This result was obtained in part by an improved construction of our ships, conferring a decided superiority of sailing, which was not less useful in enabling them to escape from superior numbers, than in enabling them to outmanœuvre the enemy when it became expedient for them to engage. A still more important element of success was our exact discipline, and the rapid exercise of our guns, whereby we were enabled to deliver three broadsides for every two received from the enemy. We may also ascribe something to the superior alacrity of our crews, who had entered the service voluntarily, over men who had been compelled to serve by forcible impressment.

The first of our naval engagements, and perhaps the most important to our national character, and the subsequent events of the war, was that between the British frigate Guerriere, commanded by Capt.

Dacres, and the Constitution, dear to every American bosom, under her other name of "Old Ironsides." She had just returned from a short cruise in which Captain Isaac Hull, her commander, had displayed the greatest nautical skill in escaping from a British fleet by which he had found himself surrounded. On the 2d of August, 1812, she again put to sea, still under the worthy and auspicious guidance of this fine specimen of a true son of the sea.

On the 19th, she fell in with the Guerriere, and gave chase to her. When within three miles of each other both ships took in their light sails, hauled up their courses, and prepared for action. The Guerriere backed her main-topsail and awaited her adversary in gallant style, having the proud ensign of England conspicuously displayed from each mast-head.

As soon as the Constitution came within gun shot, the Guerriere opened upon her, wearing and firing her broadsides alternately, but with little effect. The Constitution received her fire in silence, standing boldly on, until within half-pistol shot. Hull, who had with difficulty repressed the impatience of his crew to begin the engagement, now, standing upon a gun, gave the fearful order to fire.

The whole broadside of double-shotted guns was poured into the Guerriere with dreadful effect; and the guns again reloaded and discharged with a rapidity and precision that was truly fearful. In fifteen minutes the Guerriere's main yard was cut away in the slings, and her mizzen-mast was also seen to fall over the side. "Damn it, Jack," said a sailor to his gunmate, "but we have made a brig of her."

The Guerriere being thus unmanageable, Hull availed himself of the still perfect condition of his own ship to manœuvre and gain a raking position ahead. He swept the decks of the Guerriere from stem to stern, knocked her remaining masts away, until, in thirty minutes from the first broadside of the Constitution, the Guerriere, which at the beginning of the engagement had borne herself so proudly in all the pomp of thorough equipment, floated a complete wreck, shorn smooth with the deck; masts, sails, and rigging hanging from her channels and encumbering her decks. In this condition the Englishman, falling on board of the Constitution, still made another gallant effort to redeem his fortunes. He rallied his crew and attempted to board, but was driven back and presently after struck.

When taken possession of, the spectacle which

she presented was indeed a fearful one. Her hull every where perforated, her port-holes in many places knocked into one, and her masts with all their connecting accessories of yards, sails, and rigging lay confusedly over the decks and gunwale, or floated alongside, supporting those who had either fallen overboard during the action, or, being aloft at the time, had shared the fate of the falling masts. Upon deck the ruin was even more complete; her sides shattered, many of her guns dismounted, confused masses of sails and rigging strewed in every direction, and the mangled bodies of the dead and the dying, and they that were crushed under the fallen fragments of the wreck, completed the scene of desolation.

Yet this was the work of a single half-hour's strife. The Constitution had only fourteen men in killed and wounded, and the Guerriere one hundred in killed, wounded, and missing. The Constitution had fifty-six guns, the Guerriere forty-nine. This difference of force of course gave the Constitution the advantage of three guns in the broadside, but this is not sufficient to account for the different effects of the fire of the two ships; nor the rapidity with which the action was decided. *That one of Mr.* Canning's "fir-built frigates, with *bits of striped* bunting at their mast-heads," should

have reduced one of his Majesty's finest ships to a sinking condition in thirty minutes, was a thing not to be conceived.

A very different result had been anticipated in England and in the British Navy. Only three days before the action, Captain Dacres endorsed, on the register of a ship which he boarded, the following lines.—"Captain Dacres, Commander of his Britannic Majesty's frigate Guerriere, presents his compliments to Commodore Rodgers of the United States' frigate President, and will be happy to meet him or any other frigate of equal force to the President, off Sandy Hook, for the purpose of having a few minutes tête-à-tête." The Constitution was of the same force as the President, and we have already seen, that she soon after granted him the tête-à-tête, which in all the ardour of anticipated favours, he had so lovingly desired.

If the unexpected result of this engagement shocked the self-sufficiency of every true hearted Englishman, its effects on popular feeling in this country were much more important. The war at the beginning was far from being universally popular. Discontent and disunion prevailed in many of *the States*, and despondency had spread over all, at *the unhappy* results of our military operations on

the frontier. The war was likely to be a disastrous one, from which our national honour was to receive no accession. As yet the battle of New Orleans had not been fought; as yet our arms, tarnished by disgraceful reverses, had not been restored to the lustre, with which the war of revolution had surrounded them, by the heroic efforts of Scott and his companions at Chippewa and Niagara. This victory was a national triumph; it was felt as such from one end of the country to the other; it checked the growing despondency, and even at the focus of disaffection, they who opposed the war almost to the extent of treason, were forced into sympathy with their fellow-citizens of the whole Republic, by the pride which they felt in a victory gained by a ship, built at their own docks, and manned and commanded exclusively from among them.

Among many naval battles that shed lustre on our annals during the late war, we shall only mention two of the most brilliant, in which, though our forces were decidedly inferior, the victories were speedy and complete. One was a battle of single ships, the other of fleets.—Shortly after the declaration of war, the United States' sloop Wasp, mounting eighteen guns, and commanded by Captain *Jones*, fell in at sea with the British sloop *Frolic*, mounting twenty-two guns, and commanded

by Captain Whineyates. The superiority of the Frolic in metal consisted of four long twelve-pounders, and her superiority in crew and other respects was proportionate. Notwithstanding this extreme disparity of force, Captain Jones did not a moment decline the encounter, when the enemy offered it. The Frolic began the action with her cannon and musketry, which the Wasp did not return until within pistol shot. The British fired high, and greatly crippled the spars of the Wasp, bringing down the main-top-mast, mizzen-top-gallant-mast, and gaft, and thereby seriously embarrassed all her evolutions. In return, the Americans were not idle; they fired low, hulling the Frolic at every shot, and making up in celerity of fire what they wanted in force. Meantime both vessels had approached so near that the rammers touched in loading the guns, and the shot took terrible effect; especially that of the Wasp, which had ranged ahead, and taken a raking position, so as to sweep the whole length of her adversary's deck. The carnage caused by this fire was so dreadful that the British seamen were driven from their quarters below. At this time Captain Jones, seeing that he had the advantage, and dreading lest the crippled condition of his spars might enable the enemy to escape, determined to board, notwithstanding the danger which both vessels incurred, by encountering in so rough

a sea. The helm was put up, and the Wasp ran across the bow of the Frolic. As they struck, Lieutenants Biddle and Rodgers rushed on board, sword in hand, at the head of the boarders. They found no enemies to oppose them; the decks were covered with mutilated limbs and bodies, and were slippery with blood. Three officers alone remained standing on the quarter deck; and they hastened to throw down their swords in signal of submission. The British ensign which remained flying was quickly hauled down by Lieutenant Biddle. Thirty of the British were found dead, and forty wounded; the Americans lost but ten killed and wounded. The disparity proves conclusively the superiority of our fire. The victory won, the wounded were dressed, and every exertion was made to clear the wreck to which both vessels had been so quickly reduced. The masts of both vessels had fallen by the board; and when, soon after, in an evil hour, the Poictiers British ship-of-the-line came in sight, and bore down upon them, escape and resistance were alike impossible. Both were captured.

The battle of Lake Erie, of which we shall now speak, was fought under singular circumstances. A few months before the 10th of September, 1813, on which day it occurred, we were without any *naval force upon* that inland sea. The canoe of

the savage or the bark of the trader had alone floated upon its hitherto peaceful surface. But now war was to visit it; and the solitudes of nature, as yet accustomed only to reverberate the thunders of heaven, were to be disturbed by the more terrible engines of human wrath. The force with which Perry put forth to meet the British fleet, consisted of two large brigs, the Lawrence and Niagara, of twenty guns each, and seven smaller vessels, making in all a force of fifty-four guns and about six hundred men, a large number of whom were backwoodsmen, who had never before seen a ship. The British fleet consisted of six vessels, mounting in all sixty-three guns, and near eight hundred men. It was commanded by Captain Barclay, a veteran officer, who had lost an arm at Trafalgar; whilst Perry, his antagonist, was almost a youth.—When the British came first in sight, they were to windward; but before the action commenced, the wind changed in favour of the Americans: it was light, with clear and beautiful weather. At eleven, the British were formed in a line on the wind, and the Americans bore gallantly down upon them, the Lawrence, which led the van, displaying from her mast-head the dying words of the commander whose *name* she bore—"Don't give up the ship!" The *order of* attack had been accurately arranged; but *in case of* any interruption of it, Perry told his cap-

tains that he could not advise them better than in the words of Nelson—"If you lay your enemy alongside closely and quickly, you cannot be out of your place." At a little before noon the fire was opened upon the Lawrence; and it was not until some time after that her carronades would reach to return it. At length the battery was opened, and, the rest of the fleet not coming up, she remained during two hours exposed to the attack of nearly the whole British fleet. She was only supported by the small vessels Caledonia, Ariel, and Scorpion, which had been enabled to come up. The Niagara, Captain Elliot, equal to the Lawrence in force, and better manned, had been within hail of her shortly before the fire commenced. By backing her main-top-sail, however, she dropped so far astern, as to be in no condition to render assistance. The consequences to the Lawrence were dreadful; she was cut to pieces, and left a complete wreck: every gun, except one, which Perry himself assisted in firing, was dismounted, and scarce a dozen men remained who were not among the killed or wounded. To continue the action any longer in the Lawrence was a vain exposure of her few surviving men. But Perry was unwilling to surrender himself, and notwithstanding the increased disparity in favour of the British, which the destruction of the Lawrence

occasioned, he did not yet despair of the victory. "The American flag," said he "shall not this day be hauled down from over my head."—He entered his boat, and put off from the Lawrence, and, under a deadly fire of grape and musketry showered upon him by the enemy, steered for the Niagara, standing erect in his boat, with his sword in one hand, and in the other his battle-flag of "Don't give up the ship."—Perry passed on unhurt, and, reaching the Niagara, he hoisted his flag anew, and bore down upon the enemy. Breaking through the British ships, he raked them at pistol-shot with both broadsides. In one of the ships the British seamen were driven from the deck by the deadliness of this fire; and, the other vessels of the squadron arriving opportunely to support the Niagara, the enemy's ships began one by one to haul down their colours, until at three o'clock not a single British ensign remained flying. The Lawrence, which had been compelled to strike soon after Perry removed his flag, was now enabled to rehoist her ensign. The American loss in killed and wounded amounted to 123; that of the British to 200: the number of prisoners exceeded that with which the Americans went originally into action. The treatment of these prisoners by the victors was not less a subject of *commendation* than their bravery during the battle. *Captain Barclay*, who had been severely wounded,

was in a peculiar manner the subject of Perry's attentions, and he afterwards took occasion to speak of him in terms of equal commendation of his skill, his valour, and his humanity.

Since the last war, the growth of our navy has kept pace with our national prosperity, so far as the construction of ships is concerned. We have now a dozen ships of the line; the most spacious, efficient, and beautiful constructions that ever traversed the ocean. This is not merely an American conceit, but an admitted fact in Europe, where our models are studiously copied. In the United States, a maximum and uniform calibre of cannon has been lately determined on and adopted. Instead of the variety of length, form and calibre still used in other navies, and almost equal to the Great Michael with her "bassils, mynards, hagters, culverings, flings, falcons, double dogs, and pestilent serpenters," our ships offer flush and uniform decks, sheers free from hills, hollows and excrescences, and complete unbroken batteries of thirty-two or forty-two pounders. Thus has been realized an important desideratum—the greatest possible power to do execution coupled with the greatest simplification of the means.

But, while we have thus improved upon the

hitherto practised means of naval warfare, we are threatened with a total change. This is by the introduction of bombs, discharged horizontally, instead of shot from common cannon. So certain are those who have turned their attention to this subject that the change must take place, that, in France, they are already speculating on the means of excluding these destructive missiles from a ship's sides, by casing them in a cuirass of iron. Nor are these ideas the mere offspring of idle speculation. Experiments have been tried on hulks, by bombs projected horizontally, with terrible effect. If the projectile lodged in a mast, in exploding, it overturned it, with all its yards and rigging; if in the side, the ports were opened into each other; or, when near the water, an immense chasm was opened, causing the vessel to sink immediately. If it should not explode until it fell spent upon deck, besides doing the injury of an ordinary ball, it would then burst, scattering smoke, fire and death, on every side. When this comes to pass, it would seem that the naval profession would cease to be very desirable. Nevertheless, experience has, in all ages, shown that, the more destructive are the engines used in war, and the more it is improved and systematized, the less is the loss of *life.* *Salamis* and Lepanto can either of them alone

count many times the added victims of the Nile, Trafalgar, and Navarino.

One effect of the predicted change in naval war, it is said, will be the substitution of small vessels for the larger ones now in use. The three decker presents many times the surface of the schooner, while her superior number of cannon does not confer a commensurate advantage; for ten bombs, projected into the side of a ship, would be almost as efficacious to her destruction as a hundred. As forming part of a system of defence for our coast, the bomb-cannon, mounted on steamers, which can take their position at will, would be terribly formidable. With them—to say nothing of torpedoes and submarine navigation—we need never more be blockaded and annoyed as formerly. Hence peaceful nations will be most gainers by this change of system; but it is not enough that we should be capable of raising a blockade: we are a commercial people; our merchant-ships visit every sea, and our men-of-war must follow and protect them there.

When all nations shall be self-governed, and shall cease to exercise that injustice which almost invariably springs from the passions of individuals, *then we may* hope to realize the vision of an un-

broken peace, and naval war, like every other, may be dismissed as barbarous. But, until that happy day arrives, our character, situation and interests, all prompt us to watch over and improve our navy. Naval war may be carried on with infinitely less expense of life and money than war upon land. While a navy is impotent to the subversion of our liberties, it goes forth to meet the danger at a distance from our shores. Our fields are saved from desolation; our peaceful citizens are left to cultivate them, undisturbed by the turmoil of approaching war; and are spared from spoliation, slaughter, famine, pestilence, and all the crimes and their attendant curses, that follow in the train of armies.

THE END.